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Application of a taxonomical structure to measure worker productivity for performance evaluation

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THESIS

APPLICATION OF A TAXONOMICAL STRUCTURE TO MEASURE WORKER PRODUCTIVITY FOR PERFORMANCE EVALUATION

by

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June 1994

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Application of a Taxonomical Structure To Measure Worker Productivity For Performance Evaluation

by

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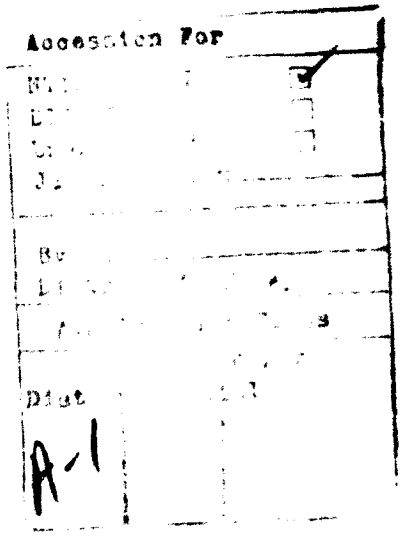
ABSTRACT

This thesis examines a potential application of using a previously developed taxonomical structure for classifying goods procured by the Federal Government to measure the productivity of Government buyers for evaluation purposes. A taxonomical approach has been employed to determine the key characteristics of goods that differentiate the amount of time and effort required to procure the good for the Federal Government. A productivity measurement model is developed based on weighted characteristics derived from utilizing a taxonomical approach.



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I. INTRODUCTION

A. BACKGROUND

The concept of contracting as a science as proposed by Steven Park in 1986 (Park, 1986, p.12) has inspired others associated with the contracting profession to research the benefit of employing classification schemes to enhance the ability of an organization to manage the contracting process. In 1990, Brian Wenger developed a classification scheme (the Wenger Model) based on a taxonomical approach for goods procured by the Federal Government (Wenger, 1990). The classification scheme was developed in an attempt to determine if a good could be accurately classified by rating it against certain fundamental characteristics, common in some degree, to all goods the Government procures. In a 1991 study by John Prendergast, validation of the Wenger model was accomplished with positive results (Prendergast, 1991). In his study Pendergast states: "In viewing the universe of items procured by the Federal Government, there is a tendency to lump them into one amorphous mass without considering the inherent characteristics of each particular good" (Prendergast, 1991, p.2) The results of Prendergast's work revealed a valid purpose for rating goods based in their inherent characteristics in order to enhance management of the

procurement process.

In December 1992, Edward Sheehan,Jr. continuing the research of Brian Wenger, identified 23 potential applications for using a taxonomical scheme within the field of Government contracting (Sheehan, 1992, p.48). Among the 23 potential applications identified by Sheehan, several of the applications focused on administrative management and procurement personnel actions. Specifically, potential applications for use of a taxonomical scheme were identified by Sheehan in the areas of personnel training and education, staffing, administrative procedures, and workload management. Common to these applications is the value of employing a taxonomical scheme to rate goods in order to provide the user with information on the varying degrees of difficulty involved with procurement of a particular good. The concept of viewing the goods that the Government procures in terms of the fundamental characteristics of the goods themselves could permit Government procurement agents to take advantage of opportunities unique to individual procurement actions. Perhaps the most advantageous product produced from using a taxonomical scheme appears to come from the knowledge and understanding that a procurement agent obtains about the goods they are purchasing. In general, the more informed a buyer is concerning the unique characteristics of the goods they are purchasing, the better chance of optimizing scarce resources. Since managers of Government procurement activities are

increasingly faced with reduced funding levels and increased demand on their resources, effective workload management within Government procurement activities is needed to accomplish agency objectives. Effective workload management starts with an accurate analysis of the work to be performed (Beeson, 1993, p.63). Additionally, identifying the tasks to be performed and the process used to accomplish these tasks is required in order to balance existing resources with demand.

A key element in the analysis of workload management is the determination of productivity measures. Use of a classification scheme, such as the Wenger Model, to identify difficulties and the amount of effort a particular procurement action may involve, can provide additional insight for management personnel to effectively and efficiently allocate the resources required to meet customer demands. Measures of productivity are usually established to determine if an organization is obtaining beneficial output from its work force. As James Walker states: "Detailed information on job tasks is required to establish precise standards of performance and opportunities for improved efficiency in job performance." (Walker, 1980, p.145)

The researcher, in the study documented by the thesis presented here, applied the principles of the Wenger model, and research conducted with respect to the Wenger classification scheme, to determine to what extent, a classification scheme can be applied to a Government

procurement field activity to measure the productivity of a worker for evaluation purposes. In the research conducted thus far, Wenger identified that the level of staffing for Government procurement offices could possibly be determined by the types of goods they purchase (Wenger, 1990, p.19). Pendergast followed by stating the "Segregation of items within the commodity can provide recognition by decision makers on the amount of effort required to make a purchase for an item" (Prendergast, 1991, p.87) And finally, Beeson revealed the need for productivity measures in contracting by quoting:

> Without a uniform means for measuring productivity or contract workload, management will continue to be limited in its ability to: (1) assess the performance of the organization, (2) project personnel requirements, (3) forecast workload requirements, or (4) prepare budgets and improve productivity. (Wright and Cummings, 1980, p.75)

This thesis applies the work of these researchers and others, in developing a proposed rating scheme based on the six fundamental characteristics presented by Wenger in his model, to measure the productivity of procurement workers in a Contracting field activity. The Fleet and Industrial Supply Center, San Diego, participated as the contracting field activity involved, with the small procurement section of the organization being the focus of the study.

B. OBJECTIVES

The primary objective of this study was to examine previously identified applications and benefits of taxonomic approaches in Federal Government contracting to develop a rating scheme that can be employed to accurately measure the productivity of contracting field workers for evaluation purposes. Specific objectives of this study are:

1. Determine to what extent the Wenger model can be applied in developing a measure of worker productivity.
2. Examine the unique environment that productivity measures are to be employed.
3. Evaluate how the classification or rating scheme can be applied.
4. Develop a model for employing a proposed rating scheme for Fleet and Industrial Supply Center, San Diego.

C. RESEARCH QUESTIONS

The following research questions guided and were addressed in this study:

Primary Research Question:

To what extent, can Government procurement activities apply a taxonomical scheme to classify goods procured by the Federal Government for the purpose of measuring the productivity of a worker for performance evaluation?

Subsidiary Research Questions:

1. What is the primary relationship that exists between the principal elements of worker productivity and the use of a taxonomical scheme to classify goods procured by the Federal Government?

2. What are the potential benefits of utilizing a taxonomical scheme to classify goods for the purpose of measuring the productivity of a worker for performance evaluation?

3. What are the perceived impediments or concerns of utilizing a taxonomical scheme to classify goods for the purpose of measuring the productivity of a worker for performance evaluation?

4. Can the proposed taxonomical scheme for classifying goods procured by the Federal Government to measure worker productivity be utilized in other applications of personnel management?

5. What are the major steps needed to implement a taxonomical scheme used to measure productivity for performance evaluation as perceived by management and supervisory personnel of Government buying activities?

RESEARCH METHODOLOGY

The research for this thesis was conducted as follows:

- Comprehensive literature review
- Preparation of a survey instrument
- Selection of a buying activity to participate in the survey and to be used as a model for implementation
- Data collection
- Data analysis
- Conduct follow-on interviews
- Presentation of data and survey
- Application of data to classification scheme for productivity measurement

The researcher conducted an in-depth review of all applicable literature on classification schemes and methods, taxonomical structures, applications of taxonomical structures

and the extent to which a taxonomical scheme can be utilized within a Government procurement office to measure productivity for personnel performance evaluation. The results of the literature review are described later in this chapter.

A Federal Government contracting activity was selected based on a request received to investigate the possibility of employing a classification scheme for the purpose of devising a measure of worker productivity. The activity chosen, Fleet and Industrial Supply Center, San Diego (FISC SD), participated in both the construction of a survey and participation in the survey. The feedback from FISC San Diego provided the opinions of experienced Government buyers that have obtained a civil service rating of GS-6 or higher and are tasked with the responsibility of procurement for a wide variety of goods and services.

D. SCOPE, LIMITATIONS AND ASSUMPTIONS

1. The scope of the research was limited to previously suggested, but undeveloped applications of the Wenger taxonomical structure for the classification of goods procured by the Federal Government. The following assumptions apply:

a. The previously developed scheme for the classification of goods procured by the Federal Government by Wenger can be used to differentiate the fundamental characteristics inherent in the goods procured.

b. The six characteristics chosen by Wenger and later validated by Prendergast, best reflect the fundamental differences among the goods procured by the Federal Government.

c. A framework can be developed to apply the Wenger classification scheme to the measurement of productivity of Government procurement agents.

2. The following limitations apply:

a. Because of time constraints, the thesis effort will only provide the conceptual framework for implementing a classification scheme to measure a buyer's productivity based on the characteristics of the goods they procure.

b. The model will not apply to services since the characteristics of services procured differ in content than does the procurement of goods.

c. Conclusions will be based on a sample of goods procured which are believed to best represent the bulk of procurement actions.

E. LITERATURE REVIEW

The model used as a basis for this study originates in the work of Brian Wenger's graduate thesis "A Taxonomical Structure for Classifying Goods Purchased by Federal Government," which provided the basic theory of classification for goods purchased by the Federal Government (Wenger, 1990). Additional studies that focused on validating and researching

possible applications of the Wenger model were also used for applying elements of the Wenger model to the measurement of a workers productivity. These studies included the works of John Prendergast in his study of "Application of A Taxonomical Structure for Classifying Goods Procured by the Federal Government," Edward Sheehan's study of "A Taxonomy of Goods Procured by the Federal Government: Applications and Benefits," and Kimberley Beeson's study of "Expanded Applications and Benefits of a Taxonomy of Goods Procured by the Federal Government," (Prendergast, 1991, Sheehan, 1992, and Beeson, 1993).

F. ORGANIZATION OF THE STUDY

The organization of this study focuses on applying previous research efforts in taxonomical schemes to an actual application of a classification scheme to measure the productivity of buyers in a Government procurement activity. Determination of the extent to which the Wenger model can be applied through direct application of the model, modification of the model, and integration of the model with other established measurement criteria is the central theme of this effort.

This chapter presented the research boundaries of this thesis in the form of primary and subsidiary research questions, methodology, scope, limitations, assumptions and the literature reviewed. Chapter II of this study provides

background information on the development and application of taxonomical schemes in Government procurement, and provides the theoretical framework for the basis of applying previous research of taxonomical schemes in the application of developing a classification scheme to measure the productivity of buyers in a selected Government procurement activity.

Chapter III provides an overview of the involvement of the Fleet and Industrial Supply Center, San Diego's Small Purchase Department, and their request for assistance in formulating a scheme for the measurement of worker productivity for evaluation purposes. A discussion of preliminary ideas for a productivity measurement scheme is also provided.

Chapter IV provides a preliminary analysis of applying the Wenger Model to the measurement of productivity. Each of the characteristics chosen by Wenger for his model are discussed with an analysis of their relevance to achieving FISC San Diego's goal of developing a productivity measurement scheme.

Chapter V discusses the preparation, application, and results, of a survey constructed to obtain a consensus on the rating of commodity groups with respect to the complexity of procuring the goods within each group. Chapter VI follows by providing a proposed model for measuring a buyer's productivity within the activity chosen for this study.

The final chapter VII, recaps the research questions and how they are addressed within the thesis. Conclusions and recommendations based on the results are made and suggestions for further research are presented.

II. THEORETICAL STRUCTURE

A. PURPOSE

The purpose of this chapter is to introduce the concept of classification with respect to Government procurement, explore some commonly identified applications of classification schemes, and to develop an understanding of the connection between classification schemes and their potential use in measuring worker productivity.

B. INTRODUCTION

Within the past few years, several researchers have studied the use of classification schemes to determine if applications exist that can enhance the ability of procurement agents and managers in managing the contracting process. Several areas of potential benefit have been identified and studied. A central theme of deriving benefit by utilizing a classification scheme to organize goods within groups that share identified and well-defined characteristics has emerged. Organizing goods into groups based on identified characteristics has provided insights into the contracting process and permitted focus on areas of potential improvement. Researchers have identified some 23 potential applications of classification schemes that can potentially assist or enhance the Federal procurement process (Sheehan, 1992). This chapter

discusses a recognized taxonomical model and its relationship to Government contracting processes. Additionally, the application of a classification scheme for measuring the productivity of procurement personnel will be briefly discussed.

C. DEFINITION OF TERMS

For the purposes of this study the following definitions are provided to clarify the meaning of selected terms:

- Classification: The ordering or arrangement of entities into groups or sets on the basis of their relationships, based on observable or inferred properties (Sokal, 1974, p.1116).

- Classification system: The end result of the process of classification, generally, a set of categories or taxa (Fleishman and Quaintance, 1984, p.22).

- Taxon (plural: taxa): A group or category in a classification system resulting from some explicit methodology (Fleishman and Quaintance, 1984, p.22).

- Taxonomy: The theoretical study of systematic classification including their bases, principles, procedures, and rules. The science of how to classify and identify. (Fleishman and Quaintance, 1984, p.22)

- Identification: The allocation or assignment of additional, unidentified objects to the correct class, once such classes have been established by prior identification (Fleishman and Quintance, 1984, p.22).

D. PURPOSE OF CLASSIFICATION

The need to classify goods procured for the Federal Government is essential primarily because of the volume of goods purchased by the Federal Government. Classifications schemes are generally employed to enhance the ability of an

organization to effectively manage large volumes of goods by providing a means of breaking down the large volumes into smaller more manageable groups. By viewing goods that the Government buys in separate categories rather than as a single homogenous group, relationships among groups are revealed which can provide insight into the process of managing those goods. The noted taxonomist, Robert Sokal said (Sokal, 1974, p.1116):

> The paramount purpose of a classification is to describe the structure and constituent objects to each other and to similar objects, and to simplify these relationships in such a way that general statements can be made about classes of objects.

Sokal further revealed that a classification system permits the achievement of four goals (Sokal, 1974, p.1116):

1. Economy of memory.
2. Ease of manipulation.
3. Ease of information retrieval.
4. Description of the structure and relationship of constituent objects.

Thus, the employment of classification schemes enables the users to incorporate methods that enhance their ability to manage and understand the objects they buy or use.

E. CLASSIFICATION PRINCIPLES

Common to all classification schemes are certain fundamental principles and conditions that must be met to ensure the classification scheme is workable and will achieve the categorical division necessary for its purpose. Shelby Hunt identified six attributes that should be present in a

classification scheme in order to meet the criteria of a successful classification. They are (Hunt, 1983, p.354):

1. The classification scheme should adequately specify the phenomenon to be classified.

2. The scheme should adequately delineate the characteristics used in classifying.

3. The scheme's categories should be mutually exclusive.

4. The scheme's categories should be collectively exhaustive.

5. The scheme's categories should be internally homogenous.

6. The classification system must serve its purpose and be useful.

This list reveals the importance of the relationship between the characteristics chosen to differentiate between and among groups of goods, and the success of the classification scheme. A common denominator is revealed that links the selection of characteristics with the purpose of the classification scheme. For example, if a classification scheme's purpose is to achieve categorization based on a particular physical trait such as color, then the characteristics chosen to segregate goods within a defined population, must relate to, and differentiate among colors within the population. If the characteristics are chosen correctly, each unit within the population will be placed into a category that differentiates or associates it into a desired grouping or category.

F. CURRENT CLASSIFICATION SCHEMES

The Federal Government currently uses two formal methods of classifying the goods they purchase. The first, the Federal Supply Classification (FSC), is based on a grouping of goods according to their commodity characteristics. The FSC consists of 78 individual groups that are divided into 620 classes. The FSC is the primary classification scheme used by supply and logistic personnel to assist in the management of the goods they handle. The second classification scheme recognized by the Federal Government is the Standard Industrial Classification (SIC). The SIC is based on economic activity and is organized to reflect the structure of the U.S. economy. The primary purpose of the SIC is to provide a means of data collection, tabulation and presentation relating to the business establishments in the United States (Lamm, Wenger 1991, p.8). While both the FSC and SIC schemes are currently being used to satisfy certain management needs, they do not satisfy the need for a uniform classification scheme to aid in the process of Federal Government procurement. Because the FSC and SIC are of limited use in the contracting process, researchers have explored alternative classification schemes which are specifically tailored to the needs of the procurement manager.

G. THE WENGER TAXONOMIC MODEL

In 1990, Brian Wenger proposed a classification scheme that focused on classifying goods based on the characteristics of the goods themselves within the context of the Federal procurement process (Wenger, 1990). Wenger's research addressed the question of: What are the essential characteristics or features of a good that are most important for classification purposes? In his analysis of which characteristics best describe goods procured by the Federal Government, Wenger developed a list of 22 characteristics shown in Table 2-1.

Wenger's original list was refined as a result of additional research, and resulted in a revised list of 12 characteristics that appear in Table 2-2. The 12 characteristics were defined and scaled to reveal distinctions between them. Wenger then conducted a survey, using an expert panel, on the 12 remaining characteristics. Cluster analysis was used to eliminate six of the characteristics that were determined to not significantly contribute to the distinction between goods.

TABLE 2-1 PRELIMINARY CHARACTERISTICS

1. Unit Value.
2. Significance of each individual purchase to the Government.
3. Time and effort spent purchasing by the buyer.
4. Rate of technological change.
5. Technical complexity.
6. Need for service (before, during, or after sale).
7. Frequency of purchase.
8. Rapidity of consumption.
9. Extent of usage (number and variety of users and variety of ways in which the good provides utility).
10. Amount of price negotiation.
11. Alternative sources available.
12. Degree of contractor financing available.
13. Amount of product homogeneity.
14. Factors considered by the buyer(price, quality, availability and technology).
15. What determines price.
16. Amount of choice available to the buyer.
17. Stability of requirement.
18. Amount of short-range versus long-range planning.
19. Usage-planned and useful consumption, or acquired as "insurance" (i.e., major weapon systems).
20. Extent to which goods are customized.
21. Extent to which buyer exercises judgement in meeting needs of requiring activity.
22. What is the nature of the demand.

(Wenger, 1990, p.27)

TABLE 2-2 REVISED GOODS CHARACTERISTICS

1. Change
2. Complexity
3. Customization
4. Maintainability
5. Homogeneity
6. Consumption
7. Unit Cost
8. Documentation
9. Item Attention
10. Sources
11. Criticality
12. Stability

(Lamm and Wenger, 1990, p.3)

The final six characteristics were then tested by application using a model designed to demonstrate categorization of 21 individual goods into homogenous groups (Wenger, 1991, p.51). Wenger's final six characteristics, along with a brief description of them as provided by Wenger, were (Wenger, 1990, p.122-123):

1. Complexity describes the good's technical intricacies. The degree of a good's complexity may be thought of in terms of the skill and expertise needed to produce the good. Another way to determine complexity is whether the good is a system subassembly, component, piece part, or raw material.

2. Customization is the degree to which the good is manufactured to the buyer's specifications. Some goods, those that are strictly commercial, have no amount of customization while others are produced exclusively for a buyer, e.g., the Government.

3. Maintainability refers to the amount of maintenance considerations associated with the good. In other words, how frequently, if at all, maintenance is required on the

good. Some goods are virtually maintenance free while others require a great deal of maintenance throughout their lives.

4. Unit Cost is the good's cost to the buyer. Generally speaking, as a good becomes more unique to the buyer's requirement, the unit value is increasing.

5. Documentation is another characteristic external to the good yet often a necessary part of it. Frequently the Government requires substantiating documentation in the form of drawings, technical manuals, and certifications for some types of goods while for others little at all is required.

6. Item Attention given by the buyer refers to a single item versus volume or mass buying. When a buyer deals with small dollar-value items like common bolts and rivets, the focus is on a mass quantity of these types of goods. Contrast this with the acquisition of an F-14 aircraft where the buyer's attention is focused on a single item.

Wenger's six characteristics achieved the desired segregation of goods within a commodity group that demonstrated the intent of the model. Additionally, Wenger's selection of characteristics met Shelby Hunt's criteria of a successful classification as mentioned in the classification principles section of this study.

The Wenger model was studied and validated by Jack Prendergast in 1991, when he applied the model to three distinct homogenous groups of goods procured for the Government (Prendergast, 1991). The groups of goods were food service equipment, ship and marine equipment, and items unique to the P-3 ORION aircraft. Prendergast concluded that (Prendergast, 1991, p.91):

The research documented by this project showed that goods procured by the Federal Government can be classified according to their inherent characteristics. This scheme

> is superior to other classification schemes which are based solely on commodity types while ignoring other vital attributes, since it conveys more information to the user (buyer).
>
> The six characteristics of Government goods classification scheme proposed by Wenger are the best characteristics for use in this scheme, as validated by the research conducted in this thesis.

H. IDENTIFIED APPLICATIONS OF THE WENGER MODEL

Following the works of Wenger and Prendergast, Edward Sheehan examined potential applications for use of the Wenger model and identified 23 possible applications within the scope of Federal Government procurement (Sheehan, 1992, p.23). Although Sheehan identified 23 potential applications for the Wenger model, he focused his research on only three applications of the model, which were market research, procurement regulation, and procurement training and education. In the conclusion of Sheehan's study, he stated that (Sheehan, 1992. p.97):

> The results of this study validate the requirement that the taxonomy be useful. This research effort identified areas of application for the taxonomy and demonstrated how the model would be useful. The taxonomy is a tool that can be used to guide and assist the procurement decision making process. It provides strategic insights not otherwise available.

Following Sheenhan's study, in 1993, Kimberley Beeson also researched potential applications of the Wenger model with a concentration on the areas of identification and utilization of commercial items, workload management, and staffing (Beeson, 1993). In her work, Beeson concluded that (Beeson,

1993, p.98):

> The taxonomy provides a sense of structure and relationship among skills, competencies and procurement tasks. Skill levels associated with individual categories of goods are identified. Management is given the tools to tailor the staffing requirements for an activity based on the particular mix of goods procured by that activity.

From the research accomplished thus far, it could be concluded that use of classification schemes could provide benefit in certain areas of Government procurement. Among the variety of potential applications of classification schemes studied, several applications have been identified as being potentially beneficial to the management of human resources within Government procurement activities. Sheehan's work identified beneficial application in the areas of procurement training and education. Beeson followed and identified beneficial application in the areas of workload management and staffing.

I. CLASSIFICATION SCHEMES AND PRODUCTIVITY MEASUREMENT

A relationship has been established in the previously mentioned studies that connects the use of classification schemes with the ability to enhance allocation of human resources. Researchers have indicated that utilization of a classification scheme could provide an increased understanding of the human output requirement specific to the procurement of certain goods. Once goods have been classified with the purpose of differentiating the effort required to procure

them, a reference point is established from which deviations can be measured. In this context, a classification scheme could be employed to measure the productivity of a worker, by designing it with the purpose of categorizing goods according to inherent characteristics that reveal the varying degrees of effort involved in the procurement process associated with the goods. Beeson, in discussing the application of a taxonomy for productivity measures, stated that (Beeson, 1993, p.73):

> Examining the individual characteristics described by the taxonomy may reveal which skill or competencies are required. Skills and task factors could be incorporated into the productivity measurement. In situations where application of the taxonomy has identified higher skill level requirements because of the nature of the good, that recognition could be tied into the number of productive units allowed for a particular transaction.

By identifying physical units of service, or human input that are linked to specific characteristics of a good, a measure of output can be determined. The premise of being able to design a classification scheme that reveals the relationship between characteristics of goods and the amount of human input, or effort, required to purchase the good provides the foundation for this study.

Productivity is generally recognized as the relationship between an output achieved, and the amount of input required to achieve that output. An agreed standard, or reference point, must first be established in order to provide a means for comparison. Use of a classification scheme can provide a starting point for developing a standard measure by first,

differentiating between the characteristics of a good with respect to the amount of human input required when dealing with a particular characteristic of that good; and secondly, once categories are established as a result of classification, a weighting scheme can be employed to provide a standard measure, or reference point, assigned to each category based on a consensus input. The relationship between a carefully designed classification scheme and the measurement of worker productivity, lies in the ability to carefully select the inherent characteristics that reveal a standard measure of effort in the procurement of specific goods. Therefore, successful employment of a classification scheme to measure worker productivity is a function of: the selection of characteristics chosen to represent the good, and a consensus-based weighting application to provide a comparison between varying levels of human output.

J. PRODUCTIVITY STANDARDS AND WEIGHTING SCHEMES

The development of productivity standards requires a determination of the time and effort required to complete the fundamental tasks involved with achieving a specific output. Standards are typically defined as the amount of output, generally meaning the amount of time, a trained worker should take to complete a defined unit of work (Wright and Cummings, 1980, p.57). For the purposes of this study, a fundamental task and a defined unit of work have the same meaning. The

identification of standards for the purpose of measuring the productivity of Government contracting personnel are derived from the tasks involved in the Government's procurement process. In broad terms, the Government procurement process for small purchases can be broken-down into six basic steps.

1. Receipt and validation of requirement.
2. Analysis of requirement.
3. Source identification.
4. Price negotiation.
5. Source selection.
6. Purchase Award.

Although each step is very broad in scope and may require numerous individual actions to complete, the steps delineate a process common to all Government small purchases. The degree of time and effort required to complete a specific step is a function of the characteristics of the good being purchased. Therefore, in order to establish productivity standards, it is necessary to identify the key characteristics of a good that represent the amount of time and effort required to purchase the good. For example, the characteristic of complexity could be used to differentiate the amount of time and effort required to accomplish each of the above steps for a variety of goods. The results of using the characteristic of complexity to categorize the differing levels of time and effort is the establishment of a standard for comparison. For goods that share a characteristic of

being highly complex, a standard could be established that indicates a larger amount of time and effort are required to complete the purchase action.

After standards have been determined and established, the assignment of weights to each of the standards provides a means of comparing the productivity of individual buyers. As Wright and Cummings stated (Wright and Cummings, 1980, p.61).

> Weighting considers the complexity and effort required to produce a purchase action and gives the worker more credit for completing more difficult tasks. Purchasing outputs can be defined in larger, easily identified units because the many steps involved in completing a given purchase action are included in the assigned weight.

K. SUMMARY

This chapter has provided a discussion of the previous research conducted on classification schemes and some of the potential applications a classification scheme can be used for. A relationship between the use of classification schemes and the measurement of a worker's productivity has also been revealed, providing a foundation for the development of a model to follow.

The next chapter will discuss the involvement of Fleet and Industrial Supply Center San Diego's Small Purchase Department and their need for a method to measure worker productivity for evaluation purposes.

III. FLEET AND INDUSTRIAL SUPPLY CENTER SAN DIEGO

A. INTRODUCTION

This chapter introduces the activity selected to participate in this thesis, the Fleet and Industrial Supply Center, San Diego, (FISC SD). FISC SD was chosen to participate in this study for the purpose of investigating if a classification scheme can be developed to measure a worker's productivity for evaluation purposes. A brief description of the mission of FISC SD will be provided, followed by an introduction to their Small Purchase activity which is the focus of this study. Additionally, a discussion of the Small Purchase activity's need for a system to measure worker productivity will be provided.

B. MISSION AND STRUCTURE OF FISC SAN DIEGO

The FISC SD, is a Naval Supply Activity responsible for providing supply/logistic products and services to Fleet, Shore and Industrial customers within a defined region. FISC SD, began service to its customers in 1922, and was then known as the Naval Supply Center, San Diego. During the past 72 years it has continually evolved in order to meet the changing needs of its customers. Chosen as a prototype for the Fleet and Industrial Supply Center concept in 1992, FISC SD has under gone many major changes within its organization

(Jablonski, 1993, p.15). The current mission of FISC SD is "to provide quality supply/logistic products and services to Fleet, Shore and Industrial customers through an innovative, talented and dedicated work force".

The organizational structure of FISC SD, has evolved into a hierarchial structure consisting of fifteen divisions which are organized by function, and report through various layers of management to a central planning authority (Galbraith, 1993). The Procurement Management Division known as Code P, is tasked with reviewing and monitoring procurement policies and procedures within the organization. Code P is unique within the FISC because it reports directly to the Commanding Officer. This direct relationship exists in order to foster a centralized planning and policy aspect designed to provide continuous improvement to the procurement process. The actual procurement of goods and services is performed at five FISC detachment sites which operate in a decentralize fashion in order to provide responsive customer service. "The goal of each FISC site is to provide one stop shopping convenience" (Vitalis, 1993).

C. FISC SAN DIEGO'S SMALL PURCHASE ACTIVITY

Within FISC SD Code P, first tier managers have been assigned responsibility for oversight of small purchase activities which are responsible for processing procurement requests subject to the limitation of the small purchase

threshold of $25,000. Currently FISC SD oversees the small purchase activities of five separately located detachments. Each detachment is responsible for purchasing a variety of goods and services in direct support of their customers. Interviews with first tier managers revealed that goods and services are purchased from more than 70 different Federal Supply Groups, involving over 550 different commodity codes as identified in the Department of Defense Procurement Coding Manual. The total business volume for the combined small purchase activities in 1993, was 62,522 purchase awards which represents the purchase of 156,321 line items with a value in excess of 86.5 million dollars.

Data are collected from all detachments and monitored by a data information system known as Automation of Procurement and Accounting Data Entry (APADE). The APADE system provides managers with detachment and individual buyer summary reports that reveal both work in progress, and procurement actions completed within a specified time period. Statistical analysis of detachment and buyer performance provided by APADE, is review by first tier managers and used as a management tool within the organization.

D. NEED FOR A SYSTEM TO MEASURE WORKER PRODUCTIVITY

As indicated by first tier mangers, and in accordance with Civil Service guidelines, each GS 1105 buyer is required to be evaluated by supervisory personnel on an annual basis.

Personnel evaluations provide feedback to employees and are used by managers for employee placement and promotion. One of the required evaluation categories is the rating of workers based on productivity. Currently within FISC SD, there is no standard method of rating an individual's productivity other than a subjective response by the person assigned as the evaluator.

Although APADE provides evaluators with statistical summaries of a buyer's workload and completed procurement actions, it does not provide a comparison of worker performance against a standard measure. Therefore, first line managers responsible for the evaluation of buyers must individually evaluate buyers based on a perceived comparison. Interviews with first tier managers disclosed plans to develop a scheme that would achieve a fair method of measuring a worker's output against an established standard for evaluation purposes.

The main goal as expressed by the first tier managers, was to develop a measurement system that would accurately differentiate the various degrees of effort required to complete a procurement action.[1] First tier managers believe that a weighting system could be developed that would assign a numeric value to a procurement action based on the time and

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[1]For the purposes of this study a procurement action includes the total time involved in a procurement from initial receipt of the requirement to contract award.

effort required to complete it. For example, a relatively simple buy would be assigned a low numeric value because it can be accomplished within a short period of time and with minimal effort, as opposed to, a complex buy that would receive a high numeric value because it requires extensive effort and a relatively large amount of time. It was expressed that the employment of such a scheme could provide a fair balance between the efforts of experienced buyers that perform difficult or complex buys against inexperienced buyers that are tasked with relatively simple buys.

E. PRELIMINARY IDEAS FOR A PRODUCTIVITY MEASUREMENT SCHEME

FISC SD, managers tasked with designing a productivity measurement scheme held several discussions to determine how a productivity rating scheme should be constructed. Discussions focused on what criteria should be used to accurately measure differences in the effort and time spent on procurement actions. Early suggestions revealed that the best course of action was to evaluate the procurement process in terms of what specific actions are involved with the procurement of different commodities. Identifying key characteristics that could be used as an indicator of the effort and time involved with procurement of a good was judged the most viable means of achieving a fair and consistent rating scheme. Some of the key characteristics that were chosen are listed in Table 3-1.

TABLE 3-1
PRELIMINARY CHARACTERISTICS
SOURCE: RESEARCHER'S INTERVIEW

1. Unit Cost
2. Number of Line Items on Requirement
3. System Versus Component
4. Purchase Method Used
5. Supply or Service
6. Unique Circumstance Requirements
7. Hazardous Material Documentation
8. Federal Information Processing (FIP) requirements
9. Commodity Code
10. Difficulty of Buy
11. Justifications Required
12. Certifications Required

It was further discussed that if a numeric valued weighting scheme could be applied to the characteristics chosen, then a system could be developed that would provide a numeric value unique to a specific procurement action. Managers involved believed that the basis for the system described was achievable and held the most promise for success.

F. SUMMARY

This chapter has introduced the Fleet and Industrial Supply Center, San Diego. A brief overview of the Small Purchase Department's need for developing a system of measuring productivity was also presented. The next chapter will present the preliminary analysis of applying the Wenger model to achieve a system of productivity measurement based in the environment of FISC, San Diego.

IV. PRELIMINARY ANALYSIS OF APPLYING THE WENGER MODEL TO THE MEASUREMENT OF PRODUCTIVITY

A. INTRODUCTION

This chapter presents a preliminary analysis concerning application of the Wenger Model to the development of a scheme for measuring the productivity of small purchase buyers. Application of productivity measurement is presented within the context of the Fleet and Industrial Supply Center, San Diego's small purchase activity's stated needs.

B. BRIEF REVIEW OF THE WENGER MODEL

One of Wenger's primary objectives was to provide strategic insight into the procurement process by providing a tool, the Wenger Model, that could be used to reveal and categorize differences between goods procured for the Federal Government (Wenger, 1990, p.25). The strategic insight provided by the Wenger Model revealed how carefully chosen characteristics could be used to categorize elements of a system so that a better understanding of the system as a whole can be achieved. Accordingly, the main purpose for using a classification scheme to measure worker productivity is to achieve a better understanding of what is involved in the procurement of a particular good. Once an understanding is achieved of what human inputs are generally required for a

given output, which in this case is a specific procurement action, then a standard measure can be established for future comparison of other like actions. Providing evaluators with a system that permits comparison or contrast of a given procurement action against a standard measure, will in turn facilitate differentiation among the productivity of workers.

The Wenger Model resulted in six skillfully chosen characteristics that adequately differentiated, as validated by Prendergast, goods procured for the Federal Government. The characteristics chosen by Wenger provide a starting point for developing a scheme to measure worker productivity. Translation of Wenger's characteristics is necessary in order to achieve a classification system specifically tailored for the purpose of establishing a standard measure of worker productivity.

C. REVIEWING WENGER'S CHARACTERISTICS

The six characteristics chosen by Wenger were selected based on the degree of influence each characteristic had in the procurement process (Wenger, 1990, p.26). As a starting point for the selection of characteristics, Wenger divided the characteristics into two groups: the first group represented those characteristics that were inherent to the good itself, and the second group represented characteristics that were external to the good. By dividing the characteristics into these two groups, Wenger was able to analyze the degree to

which each characteristic affected the procurement process. A similar approach was taken in the selection of characteristics for a scheme to measure worker productivity. A comparison of Wenger's six characteristics against the preliminary characteristics identified by FISC SD, was accomplished in two steps. The first step involved determining the degree to which Wenger's characteristics that were considered to be inherent to the good itself, which were Complexity, Customization, and Maintainability, relate to the key characteristics identified by FISC SD. The second step involves a similar comparison of Wenger's characteristics considered external to the good itself, which were Unit cost, Documentation, and Item Attention.

For ease of comparison, Table 4-1 provides a list of Wenger's six characteristics and the characteristics identified by FISC SD, as essential to productivity measurement.

A quick comparison of Wenger's six characteristics with the list of characteristics from FISC SD, reveals several similarities. Using Wenger's characteristics as a reference point for comparison, each of the six characteristics are compared or contrasted to the preliminary characteristics list from FISC SD. The purpose of this comparison is to achieve a composite characteristics list that is specifically tailored for the purpose of creating a classification model for the measurement of worker productivity.

TABLE 4-1 COMPARISON OF CHARACTERISTICS

CHARACTERISTICS OF THE GOODS	
WENGER	**FISC SAN DIEGO**
1. Complexity	1. Difficulty of Buy
2. Maintainability	2. Number of line items on requirement
3. Customization	3. System versus Component
4. Unit Cost	4. Purchase Method
5. Documentation	5. Unit Cost
6. Item Attention	6. Supply or Service
	7. Hazardous Material Documentation
	8. Federal Information Processing (FIP)
	9. Unique Circumstance Requirements
	10. Commodity Code
	11. Justifications Required
	12. Certifications Required

1. Complexity

Wenger described complexity as the good's technical intricacies, and made reference to the degree of skill and expertise needed to produce the good. Equating Wenger's complexity description to the preliminary list from FISC SD, the "difficulty of buy," infers the same intent. Both complexity and difficulty of buy refer to a good being difficult to understand, and therefore, difficult or complex to procure. Similarities between the two terms are considered sufficient to be synonymous.

2. Customization

Wenger's definition of customization was based on the degree to which a good was manufactured to the buyer's specification. Because of the organizational environment specific to the FISC SD, Small Purchase activity, no clear match can be made. Discussions during interviews with first tier managers at FISC SD, revealed that procurement of goods based on specifications was not a viable characteristic for the reason that an overwhelming majority of the procurement actions for goods procured using Government specification are considered routine because of the frequency of demand and the knowledge of the suppliers. For example, ship's rigging is often purchased based on strict military specifications. Suppliers, however, are so intimately familiar with the Government's demand for this material that the procurement is considered relatively simple. Because of perceived ambiguities in using customization to consistently differentiate between the amount of human input required in a small purchase procurement action at FISC SD, it will be eliminated from the characteristics used in this proposed model.

3. Maintainability

Maintainability as used in the Wenger Model is an inherent characteristic of a good that refers to the amount of maintenance considerations associated with the good. If

maintenance requirements of a good are considered as a part of the procurement, then buyers must evaluate factors such as: how frequently maintenance is to be performed, to what degree maintenance must be accomplished, and what is a fair dollar value for the maintenance to be performed. Interviews with FISC SD managers indicated that few small purchase actions ever involve servicing or maintenance requirements as an element of an initial contract. If maintenance or service requirements are required to support a procured good, then a service requirements contract is usually negotiated separately and not as part of the initial contract of the good.

Because maintenance requirements are not generally associated with small purchase actions, the use of maintainability as a characteristic for classification or categorization Is not believed effective.

4. Unit Cost

Unit cost was defined by Wenger as a good's cost to the buyer. Unit cost was easily identified by FISC SD, managers as a characteristic that can quickly differentiate the effort involved in a procurement action. Many small purchase requirements and regulations are tied directly to a specified dollar amount generally known as a threshold. Once a dollar threshold is reached or exceeded, then certain actions are required to be performed by purchasing agents in accordance with existing regulations and policy. For example,

if a purchases exceeds a dollar threshold of $2500, Government regulation requires quotations be solicited from a reasonable number of sources, at least three, to ensure that the Government receives a fair and reasonable price (Small Purchase Professional Development Training Guide For Mid-Career Personnel). There are additional dollar thresholds requiring specific actions by small purchase buyers at $5000 and $10,000 also.

Because a direct relationship exists between the unit cost of a good and the amount of effort required to procure that good, the characteristic is considered appropriate for use in a model designed to measure the productivity of buyers for evaluation purposes.

5. Documentation

Documentation was described by Wenger as a characteristic external to a good yet often a necessary part of procuring the good. Generally, documentation is required by the Government to substantiate that actions or conditions required by law were performed. The Federal Acquisition Regulation and its various supplements, specifically require Government procurement agents to provide or obtain numerous forms of documentation based on specific criteria. The net effect of documentation requirements is that Government buyers may expend significant time and effort, depending on the amount and type of documentation required, to ensure

compliance with existing policies.

Management personnel at FISC SD, identified four preliminary characteristics that can be grouped under general documentation requirements. They were Hazardous Material documentation, Federal Information Processing (FIP) requirements, Justification requirements, and Certification requirements. The amount of time and effort required to complete procurement actions involving any of the four types of documentation mentioned above can significantly increase the time required to complete a procurement action. Therefore, a proportional relationship is believed to exist between the amount of time and effort required to complete a procurement action for a specific good, and the amount of documentation requirements associated with that good. Since this relationship exists, the characteristic of documentation is considered consistent with the purpose of developing a model to measure a worker's productivity.

6. Item Attention

Item Attention, as defined by Wenger, refers to the amount of attention given by the buyer in a single versus volume purchase of a good. Differentiation between a relatively low attention buy, such as a volume-type purchase of rivets or nails, and a good that is always single item attention, such as an F-14 aircraft, was the intent of this characteristic. In the procurement of a major weapon system,

such as an F-14 aircraft, the characteristic of item attention serves a significant purpose by recognizing that a large amount of time and effort is required by the buyer to complete the procurement action. For Small Purchase actions, item attention as a distinguishing characteristic is limited because of the $25,000 ceiling imposed by Government regulation.

Discussions with FISC SD first tier managers, revealed that a redundancy is believed to exist between the characteristic of Item Attention and Complexity. Because of the Small Purchase threshold, the value or cost of a good is severely limited against the spectrum of goods purchased for the Federal Government. To illustrate this point, consider the purchase of a major weapon system such as a ship or aircraft, against a Small Purchase good limited in cost to under $25,000. In this example, the characteristics of Item Attention and Complexity tend to provide different benefits. For the major weapon system, both characteristics provide unique differentiation, while in the Small Purchase action, the characteristics do not provide as much differentiation and tend to share a direct relationship. The logic behind this is that the dollar threshold limits the complexity of an item to a population where the characteristic of Item Attention is not effective for the purpose of providing additional distinction among goods.

Because the characteristic of Item Attention is considered of limited value in Small Purchase actions, its use as a characteristic for the measurement of worker productivity is not considered in this study.

D. USE OF ADDITIONAL CHARACTERISTICS

Of the six characteristics chosen by Wenger, only three have been identified for use in developing a scheme to measure worker productivity. The characteristics identified as being directly applicable are Complexity, Unit Cost, and Documentation. In addition to the characteristics chosen by Wenger, there are several characteristics listed in Table 4-1 under FISC SD, that have not been addressed. The remaining characteristics tend to be more specific to the Small Purchase environment. The remaining characteristics are Number of Line Items on Requirement, System Versus Component, Purchase Method Used, Supply or Service, and the Amount of Special Attention Required. Since these characteristics tend to be more unique to the environment for which this research is being conducted, these characteristics will be discussed in Chapter VI where an actual model of a classification scheme designed to measure worker productivity is developed.

E. SUMMARY

This chapter provided a brief review of the Wenger Model, and discussed each of the six characteristics chosen by Wenger

for his model. Each characteristic was evaluated based on its applicability to a scheme for the measurement of worker productivity in the small purchase environment. A comparison of Wenger's characteristics to a list of characteristics derived from interviews at FISC SD, was conducted in an attempt to determine their benefit in an application of measuring worker productivity. Three of Wenger's characteristics were considered as directly applicable (i.e., Complexity, Unit Cost, and Documentation) and three were not (i.e., Customization, Maintainability, and Item Attention). There were several characteristics identified by FISC SD that were specific to the Small Purchase environment and will be addressed in Chapter VI.

V. SURVEY PREPARATION AND RESULTS

A. INTRODUCTION

This chapter discusses the preparation, data collection, and analysis of a survey employed in an attempt to obtain a consensus on the perceived complexity of procuring goods within identified commodity groupings. Selected survey data are also presented.

B. SURVEY PREPARATION

During initial interviews with FISC SD first tier managers, a discussion of the key characteristics most useful in differentiating the time and effort required for procurement of a particular good resulted in the identification of complexity as the most obvious choice. After identifying complexity as a "primary distinguishing characteristic," questions of how to best apply this characteristic in a classifying scheme became the challenge. A survey was designed to solicit input from FISC SD buyers with the intent of obtaining a consensus on the complexity rating of goods procured for the Federal Government. Since current procurement procedures required buyers to code each procurement action with a commodity code found in the Department of Defense Procurement Coding Manual, it was agreed that the Procurement Coding Manual provided a logical means of

grouping goods for a survey.

A survey was constructed by selecting Federal Supply Groups (FSG) that included supplies and equipment that FISC SD buyers may have a future possibility of purchasing. Seventy FSGs were selected which comprised 560 different commodity codes. The survey requested that buyers assign a rating to each commodity code based on the perceived complexity of procuring goods within the commodity code. In order to give the participants a broad range of possible responses, a five-point scale was used to rate each commodity code. A "1" on the rating scale, represented a procurement judged to be lowest in complexity, while a "5" on the rating scale, represented the most complex of procurements. The survey and the accompanying cover letter are contained in Appendix A.

C. DATA COLLECTION

1. Selection of Survey Participants

The survey was conducted entirely within the FISC SD Small Purchase activity. First tier managers agreed to champion the survey process by endorsing the survey with a cover letter that assigned specific buyers to participate in the survey. A copy of FISC SD cover letter is contained in Appendix B. The objective of choosing participants for the survey was to use an expert panel approach to obtain a consensus rating. Civil Service GS-1105 buyers with a rating of GS-7 and above were chosen as participants based on their

small purchase experience and availability.

2. Survey Response Statistics

Survey response for this project was less than anticipated. A total of 32 surveys were distributed to selected participants. Of the surveys, 21 were returned, accounting for 66% of the total.

Upon reviewing the survey responses, a problem was discovered resulting from the instructions given for completing the survey. FISC SD managers, in an attempt to obtain the best possible rating responses, requested that if a survey participant had no idea how to rate a particular commodity then they were to leave it blank. The result of this request was that, of the survey responses received, responses to the individual commodity codes ranged from a low of five responses representing only a 24% response rate, to a high of 21 responses representing a 100% response rate.

Because of the varying degrees of responses received to individual commodity codes, the researcher has selected three Federal Supply Groups containing 25 commodity codes for evaluation. Selection of the Federal Supply Groups was determined by choosing groups with relatively high response rates.

D. DATA ANALYSIS

The data analyzed are based on the Federal Supply Groups and their commodity codes listed in Table 5-1.

TABLE 5-1
SURVEY RESPONSES

FEDERAL SUPPLY GROUP 42, FIRE FIGHTING, RESCUE & SAFETY EQUIPMENT

Code	Nomenclature	Responses	Mean
4210	Fire Fighting Equipment	19	3.39
4220	Marine Lifesaving & Diving Equipment	20	3.95
4230	Decontaminating & Impregnating Equip	16	4.19
4240	Safety and Rescue Equipment	21	3.65

FSG 42 COMPOSITE SCORE 3.8 with a Standard Deviation of 0.22

FEDERAL SUPPLY GROUP 62, LIGHTING FIXTURES AND LAMPS

Code	Nomenclature	Responses	Mean
6210	Indoor & Outdoor Electric lighting Fixtures	19	2.06
6220	Electric Vehicular Lights & Fixtures	17	2.00
6230	Electric Portable & Hand Lighting Equip	19	2.00
6240	Electric Lamps	18	1.89
6250	Ballasts, Lampholders & Starters	16	2.13
6260	Nonelectrical Lighting Fixtures	17	1.82

FSG 62 COMPOSITE SCORE 1.98 with a Standard Deviation of 0.10

FEDERAL SUPPLY GROUP 70, GENERAL PURPOSE ADP EQUIP, SOFTWARE, SUPPLIES AND EQUIPMENT

Code	Nomenclature	Responses	Mean
7010	ADPE Configuration	19	3.63
7020	ADP Central Processing Unit-Analog	17	3.76
7021	ADP Central Processing Unit-Digital	15	3.73
7022	ADP Central Processing Unit-Hybrid	15	3.67
7025	ADP Input/Output and Storage Devices	16	3.56
7030	ADP Software	20	2.95
7035	ADP Support Equipment	21	3.10
7040	Punch Card Equipment	15	3.13
7042	Mini & Micro Computer Control Devices	16	3.13
7045	ADP Supplies	21	2.55
7050	ADP Components	21	2.90

FSG 70 COMPOSITE SCORE 3.28 with a Standard Deviation of 0.39

Statistics for the remaining commodity codes surveyed but not listed here are provided in Appendix C. Analysis of the data is provided in the next two sections.

1. Computed Mean Value of Commodity Codes

The objective of this survey was to obtain a standard measure of complexity derived by a consensus input from experienced contracting professionals. For the purpose of this study, a consensus constitutes a general opinion from survey participants as to the complexity rating of a particular commodity. In order to determine the consensus of survey respondents, the mean value calculation was chosen as the preferred method because it provides a weighted average of the survey responses.

Upon receipt of the completed surveys, the results of each survey were fed into a microcomputer spreadsheet program for ease of manipulation and routine calculations. Each commodity code listed on the survey was first tallied to determine the number of responses received, followed by the calculation of a mean value and standard deviation. The mean for all commodity codes was calculated to be 3.04 with a standard deviation of 0.85, indicating that most of the ratings were located in the center of the rating scale. The standard deviation of 0.085 indicates that less than a one point average variation occurred from the mean.

The data provided by the survey reveal that a general consensus can be obtained for each commodity code using this survey method. Since the surveyed population was considered to possess expert knowledge on the surveyed subject, a relatively small number of participants was considered

acceptable. However, with the unexpected input from FISC SD managers, requesting that if a participant did not know now to rate a commodity code to leave it blank, several commodity codes received only six or seven responses, which in the opinion of the researcher does not constitute a reasonable consensus. For the commodity codes receiving less than 50% response rate, another survey should be performed to ensure that a reasonable number of inputs are used.

The mean value calculated for each commodity code reflects a perceived level of complexity for the procurement of goods within that commodity code. When comparing the samples provided in Table 5-1, the data indicate that in general, purchases of Automatic Data Processing (ADP) equipment are more complex than purchases of lighting fixtures and, within the single Federal Supply Group 70, that the purchase of ADP supplies, with a rating of 2.55, is less complex than purchases of ADP Central Processing Unit-Digital equipment, which received a complexity rating of 3.73. Distinctions between commodity codes, such as the ones provided above, were the intent of using the characteristic of complexity. Therefore, the survey results are believed to be successful and support the research effort.

It is important to point out that even though a commodity may be considered a more complex purchase, this does not infer that the purchase will take a longer period of time, or require more effort than a commodity rated less complex.

This simply indicates that in general, the buyer is dealing with a good considered to be complex, based on its technical intricacies. There may be a general tendency for a more complex good to require additional time and effort to purchase; however, caution should be exercised when making such generalizations to ensure the equity among buyers.

2. Federal Supply Groups

A sample of three of the Federal Supply Groups, located in Table 5-1, were further evaluated to determine how close the composite mean of all the commodity codes within an FSG represent each of the commodity codes listed in the FSG. The implication is that a FSG generalization may be possible, that permits one rating to represent the complexity for the entire group of commodity codes within a model. Using FSG groupings in place of commodity codes could significantly reduce the volume of reference rating required for development of a standard measure.

The results of the composite mean value and standard deviation for each of the three sample FSGs are recapped in Table 5-2. The ratings appear to be a fair representative of the individual commodity codes within each FSG. The standard deviation calculation for each FSG indicates that there is a relatively normal distribution with scores within a distance of one standard deviation above the mean to one standard deviation below the mean.

TABLE 5-2
FEDERAL SUPPLY GROUP MEAN VALUE

FSG	Composite Mean	Standard Deviation
42	3.80	0.22
62	1.98	0.10
70	3.28	0.39

Although the mean of the FSGs is believed to provide a fair representation of the commodities within the FSG, use of the individual commodity code mean is preferred because of the limited number of responses to the survey.

E. SUMMARY

The survey used for this study was constructed for the purpose of obtaining a consensus on the perceived complexity of goods procured by the FISC SD small purchase activity. The survey is believed to have served its intended purpose by providing a mean score that represents the inputs received from experienced contract buyers. Although the population of people surveyed was limited, a complexity rating was achieved for 560 commodity codes with an average deviation of less than 0.9. Analysis of the survey results concluded that use of the mean calculated for each individual commodity code was preferred over the mean calculated for the entire FSG.

VI. GENERALIZED PRODUCTIVITY MEASUREMENT MODEL

A. INTRODUCTION

Since the purpose of developing a model to measure the productivity of workers is to evaluate the efforts and accomplishments of workers within an organization, it only logical to first determine what standards are going to be used to measure workers against. The standards chosen must represent a norm that an average worker could accomplish under normal conditions. For the purpose of this study, the standards are derived from a taxonomical approach which identify the key characteristics of goods that differentiate the amount of time and effort required in procurement of those goods.

This chapter discusses a generalized approach, based on the information presented thus far, for constructing a model for the measurement of worker productivity. Selection of the characteristics used for comparing individuals against a standard is discussed along with suggestions for scaling each characteristic in an attempt to ensure a fair and accurate balance among workers.

B. CRITERIA FOR SELECTION OF MEASUREMENT STANDARDS

The selection of measurement standards for a productivity measurement scheme is perhaps the most critical of all tasks

in model construction because the selected standards provide the foundation from which the scheme is built. The standards chosen must accurately represent the purpose for which the scheme was designed. In the case of productivity measurement, the object is to select standards that will provide an indication of a worker's efforts and achievements. In this thesis, a taxonomical approach is being employed to determine what the standards should be. By using a taxonomical approach, discovery of what characteristics provide the most significant differentiation is possible. After determination of those characteristics, an application can be derived from that information designed for the purpose of measuring worker output.

As discussed in Chapter IV, use of the Wenger model provides an excellent starting point for determining what characteristics best differentiate the time and effort a worker expends in the procurement of a particular good. Based on the analysis provided in Chapter IV, three of Wenger's six characteristics were determined to be directly applicable to the small purchase environment of FISC SD. The three characteristics are Complexity, Unit Cost, and Documentation. Even though these characteristics provide significant differentiation of the time and effort involved in purchasing various goods, by themselves they are not sufficient as a productivity measurement model. Additional characteristics must be explored in order to ensure that the model is balanced

and will not provide a false indication because other vital characteristics were not considered. For example, it may be possible for a good to be rated as highly complex with a large unit cost and require documentation but be a relative easy or quick purchase. This could be possible if the good is a frequently purchased component of a supported system that can be purchased under a Blanket Purchase Agreement (BPA). This example alone illustrates at least two other characteristics that should be considered in the model: (1) the type of small purchase method used, and (2) whether the good is an entire system or a component of a system. In addition to these two characteristics, other characteristics not presented in the Wenger model but relevant to FISC SD environment are identified in Table 4-1.

After comparison of the characteristics used in the Wenger model against the preliminary characteristics identified by FISC SD, there are five characteristics that remained to be examined. The five characteristics are Number of Line Items on the Requirement, System versus Component, Purchase Method Used, Supply or Service, and finally, Unique Circumstance Requirements. Each of these five characteristics are considered to be unique to the small purchase environment and directly impact the amount of time and effort required to complete a purchase action. A brief description of these characteristics is provided below in order to reveal their meaning within the context of this study.

1. Number of line Items on Requirement

The number of Line Items on the Requirement indicates the number of different goods listed on one purchase request that are required to be procured to satisfy the purchase requirement. For example, a purchase requirement may request that three components of a system be purchased under one contract to satisfy the maintenance or repair of a particular system.

2. System Versus Component

A system is a combination of components and assemblies that are combined to function as a unit or as a whole. A component on the other hand, is considered a subset of a system and cannot function independently of the system. Components do no function on their own and are used in direct support of a system in order to achieve a desired output.

3. Purchase Method Used

In the small purchase environment the purchase method refers to one of three commonly used and widely recognized purchase procedures. The three purchase methods are Blanket Purchase Agreement (BPA), Imprest Fund, and Purchase Order. Selection of a purchase method is based on optimizing the procurement time and cost in a given situation. Additionally, selection of a purchase method involves consideration of the customer's needs, price reasonableness, administrative costs and processing time, dollar amount of the purchase and current

rules and regulations.

4. Supply or Service

Supply refers to physical goods that are purchased. In contrast a service refers to the purchase of actions performed by people that result in a specified conclusion. For the purposes of this study, the characteristics associated with the procurement of services are considered substantially different than those of a supply. For this reason, and in keeping with the limitations as stated in Chapter I, the characteristic of Supply or Service will not be considered in a productivity measurement model in this study.

5. Unique Circumstance Requirements

The unique circumstance requirements refers to the amount of time spent resolving peculiar difficulties in a purchase action that are considered to be other than normal procedure.

C. SELECTED CHARACTERISTICS

Combining the characteristics chosen from the Wenger Model with four of the five characteristics mentioned above results in a comprehensive set of characteristics that provide a more balanced approach with respect to differentiation of the time and effort involved in the procurement of goods. Incorporating the seven characteristics into a classification scheme provides the foundation for a generalized model to measure worker productivity. Table 6-1 recaps the

characteristics chosen for the model and the source of each characteristic.

Examination of each individual characteristic reveals a degree to which skill, competencies, and time are required to complete a procurement action. When all seven characteristics are combined a much more comprehensive picture is provided of the time and effort involved to complete the same procurement action.

TABLE 6-1 SELECTED CHARACTERISTICS

CHARACTERISTIC	SOURCE
1. Complexity	Wenger
2. Unit Cost	Wenger
3. Documentation	Wenger
4. Number of Line Items	FISC SD
5. System Versus Component	FISC SD
6. Purchase Method Used	FISC SD
7. Unique Circumstance Requirements	FISC SD

By combining the characteristics and viewing the result as a whole, a balance among the characteristics is achieved because each characteristic is permitted to be evaluated with respect to the whole and not just itself. For example, a good may be highly complex but very low in unit cost resulting in a relatively quick and easy procurement. In this example, by using the two characteristics together, the result is that each characteristic tends to off-set each other resulting in

a more accurate depiction of what is involved in the procurement action. A balance was achieved between the two characteristics that would not otherwise have been realized if each individual characteristic had been evaluated by itself. When considering that the above example involved only two of the seven characteristics, an appreciation for the interaction of all seven characteristics on a single procurement action is possible.

D. WEIGHTING OF CHARACTERISTICS

After the selection of the characteristics to be used in the model has been achieved, the next logical step is the determination of how to devise a weighting scheme for each characteristic that will distinguish each characteristic for its net value, and will effectively contribute to a balanced rating of the overall good. The ability of a characteristic to contribute to a balanced output through its off-setting potential, as mentioned above, depends on how the elements within each characteristic are determined and weighted. Selection of the elements within each characteristic are determined based on how the characteristic is suppose to contribute to the whole scheme.

Each of the seven selected characteristics will be analyzed individually to determine what elements within the characteristic should be used, and how those elements should be broken-down into categories for the purpose of a weighting

scheme. The weighting of each element within a characteristic represents a suggestion by the researcher based on the information presented thus far and the research accomplished. For an actual application of this model, a weighting scheme should be devised that is tailored to the specific needs of the user.

1. Complexity

As discussed in Chapter IV, Complexity refers to the degree of skill and expertise needed to produce a good and is an indication of the difficulty involved in the procurement of a good. The elements within the characteristic of Complexity are identified as the various degrees of complexity determined through the use of a simple rating scale. The survey described in Chapter V, used a point assigned rating scale of "1" to "5" with a "1" on the rating scale representing a procurement judged to be lowest in complexity, and a "5" on the rating scale representing the most complex of procurements. For the purpose of this model, and for the purpose of a weighting scheme within this model, the elements of the characteristic of Complexity are determined to be as described in Table 6-2.

The rating of goods for use in this model was accomplished through a survey conducted within the FISC SD small purchase activity. Goods were grouped into categories

TABLE 6-2 ELEMENTS OF COMPLEXITY

ELEMENTS	SCALE
1. Very Low Complexity	1
2. Low Complexity	2
3. Medium Complexity	3
4. High Complexity	4
5. Very High Complexity	5

based on commodity codes and rating was performed by an expert panel. Analysis of the survey is provided in Chapter V, and results of the survey are provided in Appendix C.

2. Unit Cost

Unit Cost is defined as a good's cost to the buyer. Elements of the characteristic of Unit Cost are derived from categorizing various levels of cost, based on the amount of time and effort associated with the procurement of goods within the cost categories. Establishing the categories of cost involves determining what actions are required in order to complete a procurement action. For Government small purchase actions, regulation and policy dictate the level of actions required of procurement agents. Therefore, categorization of the characteristic of Unit Cost can be accomplished by determining milestones, in the form of actions required, that occur as the cost of goods increase until the maximum dollar threshold is reached. The milestones for Unit Cost, based on Government small purchase regulations, have been determined to occur at the following dollar levels (Small

Purchasing Professional Development Training Guide for Mid-Career Personnel).

- Purchases Under $2,500: Purchases may be accomplished without soliciting competition when prices are considered fair and reasonable. In an effort to keep administrative cost to a minimum, the buyer should only verify prices when he or she suspects the price may not be reasonable or purchases an item for which no comparable pricing information is available.

- Purchases over $2,500 but less than $5,000: These purchases require that quotations from a reasonable number of sources be solicited to ensure the Government receives a fair and reasonable price. The reasonable number is generally three or more suppliers. The buyer should include two sources not in the previous solicitation if practicable.

- Purchases over $5,000 but less than $10,000: Requirements for these purchases are similar to those between $2,500 and $5,000 except that the purchasing activities are required to post a notice of the intended procurement. Buys in the $5,000 to $10,000 range require posting the purchase description in a public place for ten days. This allows time for vendors to respond and increase competition. Oral solicitation exempt any posting requirements. Even if the solicitation is not oral an award can be made before the end of the ten day posting period.

- Purchases over $10,000 but less than $25,000: Competitive purchases over $10,000 must be posted for ten days <u>before award</u> unless oral solicitations are conducted. Then the posting requirement is exempted. The Contracting Officer must determine and document that the price of the award is reasonable.

From the requirements as set forth in Government regulation four distinct categories of unit cost are derived. Table 6-3 provides a description of the four categories as elements of the characteristic of Unit Cost and provides a simple scaling.

TABLE 6-3 ELEMENTS OF UNIT COST

	ELEMENT/CATEGORY			SCALE
1.	$ 0.00	to	$2,499	1
2.	$2,500	to	$4,999	2
3.	$5,000	to	$9,999	3
4.	$10,000	to	$25,000	4

3. Documentation

As discussed in Chapter IV, the characteristic of Documentation is external to the procured good itself, but a necessary part of the procurement process which entails varying degrees of time and effort. Buyers are required to obtain and file numerous certifications, justifications and other documentation according to specific criteria as dictated in Government regulations and policy. Requirements for documentation vary because of factors such as price, competition requirements, environmental laws, and procurement methods.

In establishing the elements of Documentation to be used in a model, basic documentation that is required and is common to all purchase actions can easily be eliminated since it does not provide any degree of differentiation. Focus is then placed on those types of documentation that result in additional time and effort being expended by a buyer, and are

related to the purchase of specific types of goods. For example, for those goods that have been identified as hazardous to the environment, a specific type of documentation is required that will result in additional time and effort being spent on the procurement of those goods. FISC SD identified four types of unique documentation that are associated with the procurement of specific goods, and that are known to result in additional time and effort being expended by buyers. The four types are hazardous material documentation, Federal Information Processing (FIP) requirements, justification requirements, and certification requirements.

Unlike the characteristics of Complexity or Unit Cost, the four types of documentation mentioned above do not provide a basis from which to categorize various levels of the time and effort required to complete a procurement action. They do however, reveal a linear relationship with respect to their involvement in the procurement of a particular good. For each type of documentation involved in a procurement action, an additional amount of time and effort must be expended. Additionally, it is possible for more than one type of documentation to be required for the procurement of an individual good. For example, it is possible for a procurement action to require sole source documentation, hazardous material documentation, and certification by the supplier. For this type of purchase the impact of the

documentation is collective and therefore, should be reflected in the amount of time and effort required to complete the procurement action.

The elements of the characteristic of Documentation are provided in Table 6-4 along with a proposed rating. Since the elements for this characteristic are considered to be collective, the rating assigned to each element are to be added if they apply to the good being procured.

TABLE 6-4 ELEMENTS OF DOCUMENTATION

	ELEMENT	RATING
1.	Hazardous Material Documentation	+1
2.	Federal Information Processing	+1
3.	Justification Documentation	+2
4.	Certification Documentation	+2

4. Number Of Line Items

The number of line items contained on a single purchase request directly impacts the amount of time and effort required to complete a purchase action. Although the number of line items on a purchase request has a direct impact, this does not indicate that there is a strict linear or proportional relationship. For instance, a purchase request with two line items will not necessarily take twice as long as a purchase request with only one item on it. This is because an economy of source is possible since the items are

purchased from a single source and under one contract. Since the relationship between the number of line items on a purchase request and the time and effort required to complete a purchase action is variable, the number of line items on a purchase request must be categorized into groups based on management's estimate. Management's estimate should consider factors such as the skill level of buyers, average number of line items on a purchase request, and the increased amount of administrative time associated with procuring additional line items. Table 6-5 provides a suggested element groupings for the characteristic of Number of Line Items.

TABLE 6-5 ELEMENTS OF NUMBER OF LINE ITEMS

ELEMENT/GROUPING	RATING
1. 1 To 3 Line Items	0
2. 4 To 12 Line Items	1
3. 13 To 30 Line Items	2
4. 30 Or More Line Items	3

Interviews revealed the normal number of line items associated with a single purchase request is believed to be less than 4, therefore, a purchase request with three or less line items is considered normal and no points are assigned.

5. System Versus Component

The main intent of developing the System Versus Component characteristic was to recognize, that on average,

the procurement of a system requires significantly more time and effort than does procuring individual components that are part of the system. Many factors contribute to making a system more difficult to procure than a component, among these factors, complexity, the type of specification used, and specialization are primary considerations. Systems are often tailored to perform specific tasks that can require the coordination of several people within an organization to ensure that the system will achieve the desired output. Additionally, buyers must often expend significant amounts of time and effort becoming familiar with the multiple features that many systems offer, and must be able to compare and contrast these features among different sources. On the other hand, components of systems are normally well defined and are purchased to exact specifications provided by the manufacturer of the system they serve.

Since there are only two elements to the characteristic of System Versus Component, which are system and component, developing a weighting scheme involves determining a ratio of the time and effort required to procure a system over procuring a component. For the purpose of this study, and as suggested during interviews, the ratio has been determined to be approximately five to one, therefore, the rating scale provides five points for purchase of a system, and one point for the purchase of a component. Table 6-6 provides the elements and ratings for the characteristic of

System Versus Component.

TABLE 6-6 ELEMENTS OF SYSTEM VERSUS COMPONENT

ELEMENT	RATING
1. Purchasing a System	5
2. Purchasing a Component	1

6. Purchase Method Used

As mentioned above, there are three purchase methods that are primarily used within a small purchase organization. Differentiating among the three methods with respect to the time and effort required to complete a purchase action results in the methods being ranked from "1" to "3", with a "1" taking the least amount of time and effort to complete, and a "3" taking the most time and effort to complete. To aid in the understanding of how each method is ranked, a brief description of each method is provided below.

- Blanket Purchase Agreement (BPA): An agreement between buyer and seller which provides a simple method of filling future repetitive needs for supplies and services through the use of low administrative involvement, such as placing orders by telephone. BPAs are often referred to as "charge accounts" established with qualified sources of supply. Orders are placed against a BPA as needs arise and payment is made on a periodic basis for all orders placed and received during the period.

- Purchase Order: A document signed by a Contracting Officer and addressed to a supplier requesting the future delivery of supplies, or the future performance of non-personal services, under the terms of the purchase order and in exchange for a promise by the Government to pay the price stated in the purchase order in the event of such

delivery or performance.

- Imprest Fund: A cash account of a fixed amount which is established in advance, without charge to an appropriation, for disbursement as needed in making payment in cash for small dollar amount purchases.

Comparison of each type of purchase method reveals that the amount of time and effort necessary to complete a purchase action will very depending on the type of purchase method selected. Table 6-7 provides a proposed rating scale for each purchase method mentioned.

TABLE 6-7 ELEMENTS OF PURCHASE METHOD

ELEMENT	RATING
1. Blanket Purchase Agreement	1
2. Imprest Fund	2
3. Purchase Order	3

7. Unique Circumstance Requirements

In order to develop a model that can deal with real world problems that may be encountered in a Government procurement activity, the characteristic of Unique Circumstance Requirements has been added. It would be virtually impossible to develop a model that could account for all the possible contingencies that could be identified. For instance, a procurement action may be subject to litigation that could result in enormous amounts of time and effort being

expended by procurement personnel, or a source may not be available for a particular procurement action. In these types of scenarios there is no way to account for the additional

TABLE 6-9 PRODUCTIVITY MEASUREMENT MODEL

CHARACTERISTIC	ELEMENTS	RATING
Complexity:		
	1. Very Low Complexity	1
	2. Low Complexity	2
	3. Medium Complexity	3
	4. High Complexity	4
	5. Very High Complexity	5
Unit Cost:		
	1. Less than $2,499	1
	2. $2,500 to $4,999	2
	3. $5,000 to $9,999	3
	4. $10,000 to $25,000	4
Documentation:		
	1. Hazardous Material	+1
	2. FIP	+1
	3. Justifications	+1
	4. Certifications	+1
Number of Line Items:		
	1. 1 to 3	0
	2. 4 to 12	1
	3. 13 to 30	2
	4. More than 30	3
System Versus Component:		
	1. System	5
	2. Component	1
Type of Purchase Method Used:		
	1. BPA	1
	2. Imprest Fund	2
	3. Purchase Order	3
Unique Circumstance Requirements:		
	1. Management's input based on circumstance	

time and effort expended by a buyer. There are numerous situations that may impact the time and effort expended by buyers and that must be accounted for on a case by case basis. The characteristic of Unique Circumstance Requirements is considered a "catch all", and is designed to provide management with a viable means of compensating for unusual circumstances that may arise.

Providing a rating scale for this characteristic is not feasible based on the fashion in which it is intended to be used, therefore, it is at management's discretion what value is placed in the rating block. Table 6-8 provides a recap of the characteristic.

TABLE 6-8 ELEMENTS OF UNIQUE CIRCUMSTANCE REQUIREMENTS

ELEMENT	RATING
1. Unique Circumstance Requirements	Management Input

E. APPLICATION OF THE MODEL

Combining the characteristics presented thus far with their perspective elements and the suggested weighted scheme results in a basic productivity measurement model that could be applied within a small purchase activity. Table 6-9 provides a composite view of the model as discussed.

The model is intended to be generic in context, and designed to be easily modified or tailored to the specific conditions of the user activity. Variables such as the skill level of buyers and the operational environment must be evaluated to determine an appropriate weighting scheme that is designed specifically to meet the needs of the user.

Actual application of the model begins with the assignment of a procurement action to a buyer within a small purchase organization. Once the procurement action has been assigned, identification of the good with respect to the characteristics in the model follows. This process entails determination of the commodity code, unit cost, documentation required, number of line items on the purchase request, whether the good is a system or component, the type of purchase method to be used, and finally if any unique circumstance requirements exist. The overall determination of the key characteristics may involve several personnel over a period of time. For example, a technical screening unit may determine the commodity code and validate the requirement, followed by a supervisor's assignment of the procurement action to a buyer who will determine the remaining characteristics based on local policy. The process will result in the selection of weighted elements from the applicable characteristics in the model. Based on the selection of weighted elements, a numeric score can be calculated that will result in a numeric value being assigned to the procurement action. The numeric value can then be

used as a tool for evaluating and comparing the procurement efforts of buyers.

As an example, for a procurement request to purchase a replacement electron tube containing a hazardous gas the following would apply:

- Commodity Code 5960
- Unit Cost $3,600
- Documentation Hazardous Material
- Number of Line Items 1
- System or Component Component
- Purchase Method Purchase Order
- Unique Circumstance Reqmts None

By applying the above information to the characteristic in the model the following numeric values are obtained:

- Complexity: (Obtained from survey) 2.44
- Unit Cost: 2
- Documentation: 1
- Number of Line Items: 0
- System or Component: 1
- Purchase Method Used: 4
- Unique Circumstance Requirements 0

Total Score For Purchase 11.44

This example illustrates how a procurement action can be translated into a numeric value based on the characteristics of the good being purchased. All similar procurement actions sharing the same characteristics should result in a similar

value. The numeric value of a purchase action will vary based on the characteristics of the good being purchased and could be used to provide management with an indication of a worker's productivity when compared to other personnel with similar tasking.

F. IMPLEMENTATION CONSIDERATIONS

Implementation of the model proposed in this chapter would require in-depth involvement by management to ensure that the characteristics selected are relevant to their particular organization, and that the weighting of the characteristics accurately reflect the skill level of their buyers, and their local policies. Use of automated devices such as microcomputers and large system computers can significantly enhance the possibility for success of this model by objectively assigning programmed numeric values during the procurement process. For FISC SD, interviews revealed that use of the APADE system can facilitate assignment of certain numeric values via available matrix programming. For example, the characteristics of complexity and unit cost can be assigned values within a programmed matrix that could automatically assign and track the total scores of individual buyers. Additional information can be programmed and tracked using the APADE system as an integrated part of the normal procurement process. Technical research and requisition validation personnel can use the model to determine values for

certain characteristics and feed the results directly into APADE. A firm commitment by management to use available resources and integrate the model with existing procedures could result in minimal impact on existing resources.

G. SUMMARY

This Chapter has discussed the construction of a generalized productivity measurement model for use in evaluating workers for evaluation purposes. Selection of the key characteristics for the model and the weighting of each characteristic was also discussed. The result of the selection of characteristics and a proposed weighting scheme, was a generalized model that provides a numeric rating for a procurement action based on the characteristics of the good purchased.

VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This research effort has led to several conclusions regarding the development of a productivity measurement scheme derived through taxonomical methods. The following conclusions are provided:

1. A taxonomical approach can be used to develop a productivity measurement model for worker evaluation purposes.

The primary conclusion drawn from this work is that a taxonomical approach can be successfully employed to create a productivity measurement system for the purpose of evaluating worker performance. The basis for this conclusion is that a taxonomical approach provides a systematic classification process that permits an ordering or arrangement of characteristics associated with the time and effort required to perform the contacting process. By identifying the key characteristics that contribute most significantly to categorizing the amounts of time and effort required to procure goods for the Federal Government, a gauging mechanism can be established that provides a measure, in this instance numeric, of worker productivity.

Chapter VI of this thesis presented a model designed for productivity measurement of Government contract buyers that

was derived by selecting key characteristics of goods procured for the Federal Government, and then applying a weighting scheme to those characteristics. The development of a weighting scheme for each characteristic was deemed critical because it provides a standard measure from which comparison and conclusions can be drawn concerning the productivity of workers. Assuming the model is applied objectively and consistently, the results will provide a numeric value for each procurement action completed which can be used as a gauge of worker output.

2. Use of a taxonomical approach for productivity measurement can enhance management of the procurement process.

Use of a taxonomical approach for productivity measurement provides insight into the procurement process that may otherwise not be discovered. A taxonomical approach involves defining the key characteristics of goods procured by the Federal Government so that groupings can be formed that reveal relationships common to the goods. From these groups which eventually constitute categories of goods, relationships are discovered based on observable or inferred properties. It is these relationships that provide management with insight into the procurement process. The benefit derived from using a taxonomical approach to enhance management's understanding of the procurement process, can result in improved decision making abilities and procurement process management within procurement activities.

3. Use of a productivity measurement model derived through a taxonomical approach can increase the objectivity of evaluating worker productivity.

Use of a productivity measurement model, similar to the one proposed in Chapter VI, could provide management with an objective means of comparing and evaluating worker productivity. Since the productivity of a worker is measured in terms of the amount of time and effort associated with procurement actions completed, there is a significantly reduced opportunity to apply subjective rating to a worker's performance. Assuming the weighting of the characteristics are a fair representation of the time and effort involved in a purchase action, and are consistently applied, then the results should be equitable and objective to all workers measured.

4. A more reasonable approach in developing a productivity measurement model would include the characteristic of Service versus Supply.

The procurement of services was not considered in this study because it was deemed to be outside the context of applying the previous research on taxonomical applications. The limitations as stated in Chapter I, focused this research effort solely on goods procured in order to determine the extent to which the previous research was applicable in developing a productivity measurement model. Interviews with small purchase personnel revealed that procurement of services is a significant task that should be considered when evaluating the productivity of buyers. It is therefore

concluded, that a more reasonable approach would be to include the characteristic of Service versus Supply in a productivity measurement model derived through a taxonomical approach.

5. A major impediment in the creation and implementation of a productivity measurement model derived from a taxonomical approach is the development of a fair and accurate weighting scheme.

Determining how each characteristic used in a productivity measurement model is to be weighted, is considered critical to the success of the model, and the most complex task in developing the model. Because each of the characteristics within the model interact with each other, the net result must be considered to determine the model's effectiveness. Off-setting characteristics must be accurately balanced to ensure that equity is maintained for buyers purchasing different types of goods.

B. RECOMMENDATIONS

The following recommendations are provided as a result of this study:

1. Use the characteristics developed for the generalized productivity measurement model as a baseline for measuring the productivity of workers in a small purchase activity.

Apply the characteristics proposed in the generalized productivity measurement model to the measurement of worker productivity within a small purchase activity to establish a baseline from which a reference point can be established. The establishment of a baseline can provide a standard from which

comparisons of worker productivity can be made. This approach may reveal strengths or weaknesses not otherwise recognized in the model.

2. Apply the same characteristics developed for the generalized productivity measurement model for large dollar contracts.

The characteristics derived for use in the generalized productivity measurement model are based on the characteristics of the good being procured and could be applied to large dollar contracts. Because concentration is on the characteristics of a good, the same characteristics should be applicable to procurements against large dollar contracts. Large dollar contracts may require that characteristics are either added or removed from the model. By applying the model to large dollar contracts a determination can be made as to the model's applicability.

3. When rating the perceived complexity of goods procured for the Federal Government, narrow the survey effort to permit focusing on single commodity groups by procurement agents responsible for actually procuring goods within the group.

The survey conducted for the purpose of obtaining a consensus on the perceived complexity of procuring goods is believed constrained because of limited participation, and because of the limited knowledge of buyers. By narrowing the scope of surveys used, and selecting buyers with knowledge of the goods being surveyed, a more concise rating of complexity could be obtained. The surveys should focus on individual

commodity groups in a standardized format, so that the data obtained on the different commodity groups can be applied in the same fashion with consistent results.

4. Apply the taxonomical scheme to other management areas.

The same methodology used in developing the proposed generalized productivity measurement model can be applied to other areas of procurement management. Using a taxonomical approach for the purpose of obtaining a better understanding of the relationship between the procurement of goods or services, and the management of the resources involved, can reveal new and innovative methods of procurement management.

C. RESEARCH QUESTIONS

Answers to the research questions proposed in Chapter I are provided below.

Primary Research Question:

To what extent, can Government procurement activities apply a taxonomical scheme to classify goods procured by the Federal Government for the purpose of measuring the productivity of a worker for performance evaluation?

Government procurement activities can apply a taxonomical scheme to classify goods procured by the Federal Government and achieve a worker productivity measurement model that will provide a gage of worker productivity, which could be used in worker performance evaluation. Application of a taxonomical

scheme does not appear to be limited with respect to its use in developing a productivity measurement model for worker performance evaluation.

Subsidiary Research Questions:

1. What is the primary relationship that exists between the principal elements of worker productivity and the use of a taxonomical scheme to classify goods procured by the Federal Government?

The primary relationship between the principal elements of worker productivity and the use of a taxonomical scheme to classify goods is based on determining the amount of worker input necessary to achieve a specified unit of output. The purpose of employing a taxonomical scheme is to determine the key characteristics of goods procured, so that a categorical separation can be achieved that can be used to differentiate the amount of time and effort associated with procurement of specified goods. From this differentiation conclusions can be drawn concerning the productivity of workers.

2. What are the potential benefits of utilizing a taxonomical scheme to classify goods for the purpose of measuring the productivity of a worker for performance evaluation?

There are two primary benefits associated with using a taxonomical scheme for the purpose of measuring worker productivity, they are:

1. Productivity measurement is based on the

characteristics of goods with respect to the time and effort required in procurement of those goods. The measurement is objective in nature and not based on subjective evaluation.

2. Use of a measurement scheme based on a taxonomical approach, will yield consistent results when applied. All evaluations are based on the same criteria and derived in the same fashion, therefore, consistent results are expected each time the scheme is applied.

3. What are the perceived impediments or concerns of utilizing a taxonomical scheme to classify goods for the purpose of measuring the productivity of a worker for performance evaluation?

The perceived concerns of utilizing a taxonomical scheme for measuring the productivity of workers are centered around the methods used to weight the characteristics chosen for the model. Weighting of each of the characteristics must be carefully determined in order to achieve a balanced and accurate outcome of the model. Some of the characteristics derived through a taxonomical approach and selected for use in a measurement model are interrelated. The relationship between these characteristics must be carefully analyzed to ensure the desired outcome will be achieved.

4. Can the proposed taxonomical scheme for classifying goods procured by the Federal Government to measure worker productivity be utilized in other applications of personnel management?

Yes, the proposed taxonomical scheme can be used in other

application of personnel management such as workload management, promotion selection, and staffing. Information derived from using the proposed taxonomical scheme could provide managers with data that could be used to determine worker's skill capabilities, backlog measurement and estimation, and the difficulties associated with the procurement of certain goods. Use of this information can enhance the allocation of resources, assist in identifying strengths and weakness, and aid in the determination of staffing requirements.

5. What are the major steps needed to implement a taxonomical scheme used to measure productivity for performance evaluation as perceived by management and supervisory personnel of Government buying activities?

The major steps needed to implement a taxonomical scheme for productivity measurement are: 1) determination and selection of the characteristics to be used in a model, 2) weighting of the characteristics in the model, and 3) validation of the model.

D. RECOMMENDATIONS FOR FURTHER RESEARCH

The following recommendations are provided for areas of further research:

1. Test the proposed model by applying it to a Government buying activity.

Actual application and validation of the proposed model could be performed within an organization such as FISC SD.

Validation of the model should involve the testing of each characteristic within the model to determine its value to the model as a whole. Additionally, development and testing of a weighting scheme for each characteristic used in the model should be performed to fully understand the interrelationships that exist between the characteristics and their net effect.

2. Explore the extent to which existing automated data information system can be used in productivity measurement schemes derived through taxonomical methods.

The extent to which automated data information systems, such as APADE, can be utilized to perform productivity measurement tasks derived through taxonomical methods is an area that can provide potential benefit to Government procurement activities. By using automated systems to calculate, monitor, and store productivity measurement information, objectivity, consistency and cost reduction could possibly be realized.

3. Test the knowledge level of Government procurement agents to determine their understanding of the goods and services they purchase.

During analysis of the survey conducted to determine a consensus of the perceived complexity of procuring goods within identified commodity groups, the knowledge level of buyers surfaced as an issue of concern. Responses to certain commodity codes revealed that the perceived level of complexity for a single commodity code ranged from simple for some buyers to the most complex of procurements for other buyers. Questions of whether the buyers really understood the

good they were rating surfaced. Additionally, what effect if any, does the level of buyer knowledge, concerning the goods they procure, have on the procurement of that good?

4. Selection of the characteristics to be used in a productivity measurement model derived through a taxonomical approach should be studied to determine if they will change for different types of operational environments.

The characteristics selected for the proposed productivity measurement model are intended to be generic in context. The characteristics should be studied to determine if they will satisfy local conditions and objectives. Variables such as the type of goods purchased, the skill level of buyers, and the operational environment must be evaluated to determine if the characteristic will achieve the differentiation of time and effort required for productivity measurement and evaluation.

5. Studies should be conducted to determine appropriate weighting schemes for each characteristic within the productivity measurement model.

Studies should be conducted to determine how each characteristic used within the productivity measurement model is to be sub-divided into weighted elements for rating productivity. Determination of how characteristics such as complexity, unit cost, and system or component are to be weighted should be based on tested data that will ensure equity and consistency when the model is applied.

6. Construct and perform an additional survey to determine a consensus rating on the perceived complexity of procuring goods within identified commodity groupings.

The survey conducted in this thesis for the purpose of obtaining a consensus on the perceived complexity of procuring goods within identified commodity groups is believed constrained because of limited participation. It is recommended that an additional survey be performed to validate the accuracy of the data presented in the survey. Narrowing the scope of the surveys and selecting experienced buyers should be considered in an attempt to achieve the best results possible.

APPENDIX A

Cover letter and Survey on the perceived complexity of procuring goods within identified commodity groupings.

PRIDE IN PROCUREMENT

You are being asked to participate in the following survey because you have been identified as an experienced Government procurement agent. This survey is being conducted to develop a system to fairly and accurately measure the productivity of buyers based on the complexity and difficulties of purchasing goods for the Government. The following survey concentrates only on the differenced in complexity of goods purchased. Please carefully read the definition of complexity an keep it in mind when rating the goods listed in the survey. Your input will be used to obtain a consensus on the complexity of purchasing a group of goods within a particular commodity code and will be incorporated into an rating scheme to determine the productivity of different procurement actions based on a commodity code grouping.

Complexity describes the good's technical intricacies. The degree of a good's technical complexity may be through of in terms of the skill and expertise needed to procure the good. Another way to look at complexity of a good is to think of the technology involved in producing the good. For scoring purposes, 1 indicates little or no technological complexity and 5 indicates very high complexity.

Scale

1 Very low technical complexity
2 Low technical complexity
3 Medium technical complexity
4 High technical complexity
5 Very high technical complexity

Please circle a number between 1 and 5 for each commodity code that best describes the complexity of the range of goods within the commodity code For the purposes of this survey please focus only on the complexity of the goods within a commodity group and do not consider other procurement factors.

Federal Supply Group		Rating Scale (1-5)
(12) Fire Control Equipment		
1. Fire Control Directors	(1210)	1 2 3 4 5
2. Fire Control Computing Sight & Devices	(1220)	1 2 3 4 5
3. Fire Control Systems, Complete	(1230)	1 2 3 4 5
4. Optical Sighting & Ranging Equipment	(1240)	1 2 3 4 5
5. Fire Control Stabilizing Mechanisms	(1250)	1 2 3 4 5
6. Fire Control Designating & Indicating Equipment	(1260)	1 2 3 4 5
7. Fire Control Transmitting & Receiving Equipment	(1265)	1 2 3 4 5
8. Aircraft Gunnery Fire Control Components	(1270)	1 2 3 4 5
9. Aircraft Bombing Fire Control Components	(1280)	1 2 3 4 5
10. Fire Control Radar Equipment Except Airborne	(1285)	1 2 3 4 5
11. Fire Control Sonar Equipment	(1287)	1 2 3 4 5
12. Miscellaneous Fire Control Equipment	(1290)	1 2 3 4 5
(15) Aircraft &Airframes Structural Components		
1. Aircraft Fixed Wing	(1510)	1 2 3 4 5
2. Aircraft Rotary Wing	(1520)	1 2 3 4 5
3. Gliders	(1540)	1 2 3 4 5
4. Drones	(1550)	1 2 3 4 5
5. Airframe Structural Components	(1560)	1 2 3 4 5
(16) Aircraft Components & Accessories		
1. Aircraft Propellers	(1610)	1 2 3 4 5
2. Helicopter Rotor Blades, Drive Mechanisms	(1615)	1 2 3 4 5
3. Aircraft Landing Gear Components	(1620)	1 2 3 4 5
4. Aircraft Wheel & Brake Systems	(1630)	1 2 3 4 5
5. Acft Hydraulic, Vacuum & De-icing Sys Components	(1650)	1 2 3 4 5
6. Aircraft Airconditing Heating & Pressurizing Equipment	(1660)	1 2 3 4 5
7. Parachutes & Cargo Tie Down Equipment	(1670)	1 2 3 4 5

8. Misc. Aircraft Accessories & Components	(1680)	1	2	3	4	5
(17) Aircraft Launching, Ldg & Grnd Handling Equip						
1. Aircraft Landing Equipment	(1710)	1	2	3	4	5
2. Aircraft Launching Equipment	(1720)	1	2	3	4	5
3. Aircraft Ground Servicing Equipment	(1730)	1	2	3	4	5
4. Airfield Specialized Trucks and Trailers	(1740)	1	2	3	4	5
(19) Ships, Small Craft, Pontoons & Floating Docks						
1. Combat Ships & Landing Vessels	(1905)	1	2	3	4	5
2. Transport Vessels, Passenger & Troop	(1910)	1	2	3	4	5
3. Cargo & Tanker Vessels	(1915)	1	2	3	4	5
4. Fishing Vessels	(1920)	1	2	3	4	5
5. Special Service Vessels	(1925)	1	2	3	4	5
6. Barges & Lighters, Cargo	(1930)	1	2	3	4	5
7. Barges. & Lighters, Special Purpose	(1935)	1	2	3	4	5
8. Small Craft	(1940)	1	2	3	4	5
9. Pontoons & Floating Docks	(1945)	1	2	3	4	5
10. Floating Dry Docks	(1950)	1	2	3	4	5
11. Dredges	(1955)	1	2	3	4	5
12. Miscellaneous Vessels	(1990)	1	2	3	4	5
(20) Ship & Marine Equipment						
1. Ship & Boat Propulsion Equipment	(2010)	1	2	3	4	5
2. Rigging & Rigging Gear	(2020)	1	2	3	4	5
3. Deck Machinery	(2030)	1	2	3	4	5
4. Marine Hardware & Hull Items	(2040)	1	2	3	4	5
5. Buoys	(2050)	1	2	3	4	5
6. Commercial Fishing Equipment	(2060)	1	2	3	4	5
7. Miscellaneous Ship & Marine Equipment	(2090)	1	2	3	4	5
(22) Railway Equipment						
1. Locomotives	(2210)	1	2	3	4	5
2. Rail Cars	(2220)	1	2	3	4	5
3. Right-of-way Const. & Maint Equip, Railroad	(2230)	1	2	3	4	5
4. Locomotive & Rail Car Accessories & Components	(2240)	1	2	3	4	5
5. Track Material, Railroad	(2250)	1	2	3	4	5

(23) Ground Effect Veh, Motor Veh, Trailers & Cycles		
1. Ground Effect Vehicles	(2305)	1 2 3 4 5
2. Passenger Motor Vehicles	(2310)	1 2 3 4 5
3. Trucks & Truck Tractors, Wheeled	(2320)	1 2 3 4 5
4. Trailers	(2330)	1 2 3 4 5
5. Motorcycles, Motor Scooters & Bicycles	(2340)	1 2 3 4 5
6. Combat Assault & Tactical Vehicles, Tracked	(2350)	1 2 3 4 5
(24) Tractors		
1. Tractor, Full Tracked, Low Speed	(2410)	1 2 3 4 5
2. Tractors Wheeled	(2420)	1 2 3 4 5
3. Tractors, Full Tracked, High Speed	(2430)	1 2 3 4 5
(25) Vehicular Equipment Components		
1. Vehicular Cab, Body, Frame, Structural Comp	(2510)	1 2 3 4 5
2. Vehicular, Power Transmission Components	(2520)	1 2 3 4 5
3. Vehicular, Brake, Steering, Axle Wheel Comp	(2530)	1 2 3 4 5
4. Vehicular, Furniture & Accessories	(2540)	1 2 3 4 5
5. Miscellaneous Vehicular Components	(2590)	1 2 3 4 5
(26) Tubes & Tires		
1. Tires & Tubes, Pneumatic, Except Aircraft	(2610)	1 2 3 4 5
2. Tires & Tubes, Pneumatic Aircraft	(2620)	1 2 3 4 5
3. Tires Solid & Cushion	(2630)	1 2 3 4 5
4. Tire Rebuilding & Tire & Tube Repair Mats	(2640)	1 2 3 4 5
(28) Engines, Turbines & Components		
1. Gas Reciprocating Eng. Except Aircraft; & Comps	(2805)	1 2 3 4 5
2. Gas Reciprocating Eng., Aircraft; & Components	(2810)	1 2 3 4 5
3. Diesel Engines & Components	(2815)	1 2 3 4 5
4. Steam Engines, Reciprocating; & Components	(2820)	1 2 3 4 5
5. Steam Turbines & Components	(2825)	1 2 3 4 5
6. Water Turbines & Water Wheels; & Components	(2830)	1 2 3 4 5
7. Gas Turbines & Jet Eng. Except Aircraft : & Comps	(2835)	1 2 3 4 5
8. Gas Turbines & Jet Engines, Aircraft: & Components	(2840)	1 2 3 4 5

9. Rocket Engines & Components	(2845)	1 2 3 4 5
10. Gasoline Rotory Engines & Components	(2850)	1 2 3 4 5
11. Miscellaneous Engines & Components	(2895)	1 2 3 4 5
(29) Engine Accessories		
1. Engine Fuel Sys Components, Nonaircraft	(2910)	1 2 3 4 5
2. Engine Fuel System Components, Aircraft	(2915)	1 2 3 4 5
3. Engine Electrical System Comps, Nonaircraft	(2920)	1 2 3 4 5
4. Engine Electrical System Comps, Aircraft	(2925)	1 2 3 4 5
5. Engine Cooling System Components, Nonaircraft	(2930)	1 2 3 4 5
6. Engine Cooling System Components, Aircraft	(2935)	1 2 3 4 5
7. Eng Filters, Strainers & Cleaners, Nonaircraft	(2940)	1 2 3 4 5
8. Eng Filters , Strainers & Cleaners, Aircraft	(2945)	1 2 3 4 5
9. Tubrosuperchargers	(2950)	1 2 3 4 5
10. Miscellaneous Engine Accessories, Nonaircraft	(2990)	1 2 3 4 5
11. Miscellaneous Engine Accessories, Aircraft	(2995)	1 2 3 4 5
(30) Mechanical Power Transmission Equipment		
1. Torque Converters & Speed Changers	(3010)	1 2 3 4 5
2. Gears, Pulleys, Sprockets & Trans Chain	(3020)	1 2 3 4 5
3. Belting, Drive Belts, Fan Belts & Accys	(3030)	1 2 3 4 5
4. Miscellaneous Power Transmission Equip	(3040)	1 2 3 4 5
(31) Bearings		
1. Bearings, Antifriction, Unmounted	(3110)	1 2 3 4 5
2. Bearings, Plain Unmounted	(3120)	1 2 3 4 5
3. Bearings, Mounted	(3130)	1 2 3 4 5
(32) Woodworking Machinery & Equipment		
1. Sawmill & Planing Mill Machinery	(3210)	1 2 3 4 5
2. Woodworking Machines	(3220)	1 2 3 4 5
3. Tools & Attachments For Woodworking Machinery	(3230)	1 2 3 4 5
(34) Metalworking Machinery		
1. Saws & Filing Machines	(3405)	1 2 3 4 5
2. Machining Centers & Way-Type Machines	(3408)	1 2 3 4 5
3. Electrical & Ultrasonic Erosion Machines	(3410)	1 2 3 4 5

4. Boring Machines	(3411)	1	2	3	4	5
5. Broaching Machines	(3412)	1	2	3	4	5
6. Drilling & Tapping Machines	(3413)	1	2	3	4	5
7. Gear Cutting & Finishing Machines	(3414)	1	2	3	4	5
8. Grinding Machines	(3415)	1	2	3	4	5
9. Lathes	(3416)	1	2	3	4	5
10. Milling Machines	(3417)	1	2	3	4	5
11. Planers & Shapers	(3418)	1	2	3	4	5
12. Miscellaneous Machine Tools	(3419)	1	2	3	4	5
13. Rolling Mills & Drawing Machines	(3422)	1	2	3	4	5
14. Metal Heat Treating & Non-Thermal Equip	(3424)	1	2	3	4	5
15. Metal Finishing Equipment	(3426)	1	2	3	4	5
16. Electric Arc Welding Equipment	(3431)	1	2	3	4	5
17. Electric Resistance Welding Equipment	(3432)	1	2	3	4	5
18. Gas Welding, Heat Cutting & Metalizing Equip	(3433)	1	2	3	4	5
19. Welding Positioners & Manipulators	(3436)	1	2	3	4	5
20. Miscellaneous Welding Equipment	(3438)	1	2	3	4	5
21. Misc. Welding Soldering & Brazing Supplies	(3439)	1	2	3	4	5
22. Bending & Forming Machines	(3441)	1	2	3	4	5
23. Hydraulic & Pneumatic Presses, Power Driven	(3442)	1	2	3	4	5
24. Mechanical Presses, Power Driven	(3443)	1	2	3	4	5
25. Manual Presses	(3444)	1	2	3	4	5
26. Punching & shearing Machines	(3445)	1	2	3	4	5
27. Forging Machinery & Hammers	(3446)	1	2	3	4	5
28. Wire & Metal Ribbon Forming Machines	(3447)	1	2	3	4	5
29. Riveting Machines	(3448)	1	2	3	4	5
30. Misc Secondary Metal Forming & Cutting Mach	(3449)	1	2	3	4	5
31. Machines Tools, Portable	(3450)	1	2	3	4	5
32. Cutting Tools For Machine Tools	(3455)	1	2	3	4	5
33. Cutting Tools For Secondary Metal Mach	(3456)	1	2	3	4	5
34. Machine Tool Accessories	(3460)	1	2	3	4	5
35. Accessaries For Secondary Metal Machinery	(3461)	1	2	3	4	5
36. Production Jigs, Fixtures & Templates	(3465)	1	2	3	4	5
37. Machine Shop Sets, Kits & Outfits	(3470)	1	2	3	4	5

(35) Service & Trade Equipment		
1. Laundry & Dry Cleaning Equipment	(3510)	1 2 3 4 5
2. Shoe Repairing Equipment	(3520)	1 2 3 4 5
3. Indust Sewing Machine & Mobile Tex Repr Shops	(3530)	1 2 3 4 5
4. Wrapping & Packaging Machinery	(3540)	1 2 3 4 5
5. Vending & Coin Operated Machines	(3550)	1 2 3 4 5
6. Miscellaneous Service & Trade Equipment	(3590)	1 2 3 4 5
(36) Special Industry Machinery		
1. Food Products Machinery & Equipment	(3605)	1 2 3 4 5
2. Printing, Duplicating & Bookbinding Equip	(3610)	1 2 3 4 5
3. Industrial Marking Machines	(3611)	1 2 3 4 5
4. Pulp & Paper Industries Machinery	(3615)	1 2 3 4 5
5. Rubber & Plastic Working Machinery	(3620)	1 2 3 4 5
6. Textile Industries Machinery	(3625)	1 2 3 4 5
7. Clay & Concrete Products Industries Mach	(3630)	1 2 3 4 5
8. Crystal & Glass Industries Machinery	(3635)	1 2 3 4 5
9. Tobacco Manufacturing Machinery	(3640)	1 2 3 4 5
10. Leather Tanning & Working Machinery	(3645)	1 2 3 4 5
11. Chemical & Pharmaceutical Machinery	(3650)	1 2 3 4 5
12. Gas Generating & Despensing Systems	(3655)	1 2 3 4 5
13. Industrial Size Reduction Machinery	(3660)	1 2 3 4 5
14. Specialized Circuit Board Manufacturing Mach	(3670)	1 2 3 4 5
15. Foundry Machinery, Related Equip & Sup	(3680)	1 2 3 4 5
16. Specialized Metal Container Mfg Mach & Equip	(3685)	1 2 3 4 5
17. Specialized Ammunition & Ordnance Mach	(3690)	1 2 3 4 5
18. Industrial Assembly Machines	(3693)	1 2 3 4 5
19. Clean Work Stations, Controlled Environ Eq	(3694)	1 2 3 4 5
20. Miscellaneous Special Industry Machinery	(3695)	1 2 3 4 5
(37) Agriculture Machinery & Equipment		
1. Soil Preparation Equipment	(3710)	1 2 3 4 5
2. Harvesting Equipment	(3720)	1 2 3 4 5
3. Dairy, Poultry & Livestock Equipment	(3730)	1 2 3 4 5
4. Pest, Disease & Frost Control Equipment	(3740)	1 2 3 4 5

5. Gardening Implements & Tools	(3750)	1 2 3 4 5
6. Animal Drawn Vehicles & Farm Trailers	(3760)	1 2 3 4 5
7. Saddlery, Harness, Whips & Furnishings	(3770)	1 2 3 4 5
(38) Const, Mining, Excavating & Hwy Maint Equip		
1. Earth Moving & Excavating Equip	(3805)	1 2 3 4 5
2. Cranes & Crane-shovels	(3810)	1 2 3 4 5
3. Cranes & Crane-shovel Attachments	(3815)	1 2 3 4 5
4. Mining, Rock Drilling, Earth Boring & Rel Equip	(3820)	1 2 3 4 5
5. Road Clearing & Cleaning Equipment	(3825)	1 2 3 4 5
6. Truck & Tractor Attachments	(3830)	1 2 3 4 5
7. Petroleum Production & Distribution Equipment	(3835)	1 2 3 4 5
8. Miscellaneous Construction Equipment	(3890)	1 2 3 4 5
9. Small Craft	(3890)	1 2 3 4 5
(39) Material Handling Equipment		
1 Conveyors	(3910)	1 2 3 4 5
2 Material Feeders	(3915)	1 2 3 4 5
3 Matl Handling Equip, Nonself-propelled	(3920)	1 2 3 4 5
4 Warehouse Trks & Tractors, Self-propelled	(3930)	1 2 3 4 5
5. Blocks, Tackle, Rigging & Slings	(3940)	1 2 3 4 5
6 Winches, Hoists, Cranes & Derricks	(3950)	1 2 3 4 5
7. Elevators & Escalators	(3960)	1 2 3 4 5
8 Miscellaneous Materials Handling Equip	(3990)	1 2 3 4 5
(40) Rope, Cable, Chain & Fittings		
1 Chain & Wire rope	(4010)	1 2 3 4 5
2. Fiber Rope, Cordage & Twine	(4020)	1 2 3 4 5
3. Fittings For Rope, Cable & Chain	(4030)	1 2 3 4 5
(41) Refrigeration, AC & Air Circulating Equip		
1 Refrigeration Equip	(4110)	1 2 3 4 5
2. Air Conditioning Equip	(4120)	1 2 3 4 5
3. Refrigeration & Air Conditioning Comps	(4130)	1 2 3 4 5
4. Fans, Air Circulators & Blower Equip	(4140)	1 2 3 4 5
(42) Fire Fighting, Rescue & Safety Equipment		

1. Fire Fighting Equipment	(4210)	1 2 3 4 5
2. Marine Lifesaving & Diving Equipment	(4220)	1 2 3 4 5
3. Decontaminating & Impregnating Equip	(4230)	1 2 3 4 5
4. Safety & Rescue Equipment	(4240)	1 2 3 4 5
(43) Pumps & Compressors		
1. Compressors & Vacuum Pumps	(4310)	1 2 3 4 5
2. Power & Hand Pumps	(4320)	1 2 3 4 5
3. Centrifugals, Separations & Filters	(4330)	1 2 3 4 5
(44) Furnace, Steam Plant & Drying Equip & Nucl		
1. Industrial Boilers	(4410)	1 2 3 4 5
2. Heat Exchangers & Steam Condensers	(4420)	1 2 3 4 5
3. Industrial Furnaces, Kilns, Lehrs & Ovens	(4430)	1 2 3 4 5
4. Dryers, Dehydrators & Anhydrators	(4440)	1 2 3 4 5
5. Air Purification Equipment	(4460)	1 2 3 4 5
6. Nuclear Reactors	(4470)	1 2 3 4 5
(45) Pluming, Heating & Sanitation Equipment		
1. Pluming Fixtures & Accessories	(4510)	1 2 3 4 5
2. Space Heating Equipment & Domestic Water Heaters	(4520)	1 2 3 4 5
3. Fuel Burning Equipment Units	(4530)	1 2 3 4 5
4. Misc Pluming, Heating & Sanitation Equip	(4540)	1 2 3 4 5
(46) Water Purification & Sewage Treatment Equip		
1. Water Purification Equipment	(4610)	1 2 3 4 5
2. Water Distillation Equip Marine & Indust	(4620)	1 2 3 4 5
3. Sewage Treatment Equipment	(4630)	1 2 3 4 5
(47) Pipe, Tubing, Hose & Fittings		
1. Pipe & Tube	(4710)	1 2 3 4 5
2. Hose & Tubing, Flexible	(4720)	1 2 3 4 5
3. Fittings & Specialties: Hose, Pipe & Tube	(4730)	1 2 3 4 5
(48) Valves		
1. Valves, Powered	(4810)	1 2 3 4 5
2. Valves, Nonpowered	(4820)	1 2 3 4 5
(49) Maintenance & Repair Shop Equipment		

1. Motor Veh Maint & Repr Shop Specialized Equip	(4910)	1	2	3	4	5
2. Acft Maint & Repair Shop Specialized Equip	(4920)	1	2	3	4	5
3. Torpedo Maint, Repair & Checkout Spec Equip	(4921)	1	2	3	4	5
4. Depth Charges, Mines Maint & Repair Equip	(4923)	1	2	3	4	5
5. Ammunition Maint, Repair & Checkout Spec Equip	(4925)	1	2	3	4	5
6. Rocket Maint, Repair & Checkout Spec Equip	(4927)	1	2	3	4	5
7. Lubrication & Fuel Dispensing Equipment	(4930)	1	2	3	4	5
8. Fire Control Maint & Repair Shop Spec Equip	(4931)	1	2	3	4	5
9. Weapons Maint & Repair Shop Spec Equip	(4933)	1	2	3	4	5
10. Guided Missile Maint. Repair Specialized Equip	(4935)	1	2	3	4	5
11. Miscellaneous Maint, Repair Specialized Equip	(4940)	1	2	3	4	5
12. Space Vehicle Maint, Repair Specialized Equip	(4960)	1	2	3	4	5
(51) Hand Tools						
1. Hand Tools, Edged, Nonpowered	(5110)	1	2	3	4	5
2. Hand Tools, Nonedged, Nonpowered	(5120)	1	2	3	4	5
3. Hand tools, Power Driven	(5130)	1	2	3	4	5
4. Drill Bits, Counterbores & Countersinks	(5133)	1	2	3	4	5
5. Taps, Dies & Collets: Hand & Machine	(5136)	1	2	3	4	5
6. Tools & Hardware Boxes	(5140)	1	2	3	4	5
7. Sets, Kits & Outfits of Hand Tools	(5180)	1	2	3	4	5
(52) Measuring Tools						
1. Measuring Tools, Craftsmen's	(5210)	1	2	3	4	5
2. Inspection Gauges & Precision Layout Tools	(5220)	1	2	3	4	5
3. Sets, Kits & Outfits of Measuring Tools	(5280)	1	2	3	4	5
(53) Hardware & Abrasives						
1. Screws	(5305)	1	2	3	4	5
2. Bolts	(5306)	1	2	3	4	5
3. Studs	(5307)	1	2	3	4	5
4. Nuts & Washers	(5310)	1	2	3	4	5
5. Nails, Keys & Pins	(5315)	1	2	3	4	5
6. Rivets	(5320)	1	2	3	4	5
7. Fastening Devices	(5325)	1	2	3	4	5
8. Packing & Gasket Materials	(5330)	1	2	3	4	5

9. Metal Screening	(5335)	1 2 3 4 5
10. Miscellaneous Hardware	(5340)	1 2 3 4 5
11. Disks & Stone Abrasives	(5345)	1 2 3 4 5
12. Abrasive Materials	(5350)	1 2 3 4 5
13. Knobs & Pointers	(5355)	1 2 3 4 5
14. Coil, Flat & Wire Springs	(5360)	1 2 3 4 5
15. Rings, Shims & Spacers	(5365)	1 2 3 4 5
(54) Prefabricated Structures & Scaffolding		
1. Prefabricated & Portable Buildings	(5410)	1 2 3 4 5
2. Rigid Wall Shelters	(5411)	1 2 3 4 5
3. Bridges, Fixed & Floating	(5420)	1 2 3 4 5
4. Storage Tanks	(5430)	1 2 3 4 5
5. Scaffolding Equipment & Concrete Forms	(5440)	1 2 3 4 5
6. Prefabricated Tower Structures	(5445)	1 2 3 4 5
7. Miscellaneous Prefabricated Structures	(5450)	1 2 3 4 5
(55) Lumber, Millwork, Plywood & Veneer		
1. Lumber & Related Basic Wood Materials	(5510)	1 2 3 4 5
2. Millwork	(5520)	1 2 3 4 5
3. Plywood & Veneer	(5530)	1 2 3 4 5
(56) Construction & Building Materials		
1. Mineral Construction Materials, Bulk	(5610)	1 2 3 4 5
2. Building Glass, Tile, Brick & Block	(5620)	1 2 3 4 5
3. Pipe & Conduit, Nonmetallic	(5630)	1 2 3 4 5
4. Wallboard, Bldg Paper & Thermal Insulation	(5640)	1 2 3 4 5
5. Roofing & Siding Materials	(5650)	1 2 3 4 5
6. Fencing, Fences & Gates	(5660)	1 2 3 4 5
7. Building Components, Prefabricated	(5670)	1 2 3 4 5
8. Miscellaneous Construction Material	(5680)	1 2 3 4 5
(58) Communication, Detection & Coherent Radiation Equip		
1. Telephone & Telegraph Equip	(5805)	1 2 3 4 5
2. Communications Security Equip & Comps	(5810)	1 2 3 4 5
3. Other Cryptologic Equipment & Components	(5811)	1 2 3 4 5

4. Teletype & Facsimile Equipment	(5815)	1	2	3	4	5
5. Radio & TV Comm Equipment, Except Airborne	(5820)	1	2	3	4	5
6. Radio & TV Comm Equipment, Airborne	(5821)	1	2	3	4	5
7. Radio Navigation Equipment, Expect Airborne	(5825)	1	2	3	4	5
8. Radio Navigation Equipment, Airborne	(5826)	1	2	3	4	5
9. Intercomm & Public Address Sys, Except Airborne	(5830)	1	2	3	4	5
10. Intercomm & Public Address Sys, Airborne	(5831)	1	2	3	4	5
11. Sound Recording & Reproducing Equipment	(5835)	1	2	3	4	5
12. Video Recording & Reproducing Equipment	(5836)	1	2	3	4	5
13. Radar Equipment, Except Airborne	(5840)	1	2	3	4	5
14. Radar Equipment, Airborne	(5841)	1	2	3	4	5
15. Underwater Sound Equipment	(5845)	1	2	3	4	5
16. Visible & Invisible Light Comm Equipment	(5850)	1	2	3	4	5
17. Night Vision Equipment	(5855)	1	2	3	4	5
18. Stimulated Coherent Radiation Devices	(5860)	1	2	3	4	5
19. Elct Countermeasures & Quick Reaction Equip	(5865)	1	2	3	4	5
20. Miscellaneous Communication Equipment	(5895)	1	2	3	4	5
(59) Electrical & Electronic Equipment Components						
1. Resistors	(5905)	1	2	3	4	5
2. Capacitors	(5910)	1	2	3	4	5
3. Filters & Networks	(5915)	1	2	3	4	5
4. Fuses, Arrestors, Absorbers & Protectors	(5920)	1	2	3	4	5
5. Circuit Breakers	(5925)	1	2	3	4	5
6. Switches	(5930)	1	2	3	4	5
7. Connectors, Electrical	(5935)	1	2	3	4	5
8. Lugs, Terminals & Terminal Strips	(5940)	1	2	3	4	5
9. Relays & Solenoids	(5945)	1	2	3	4	5
10. Coils & Transformers	(5950)	1	2	3	4	5
11. Oscillators & Piezoelectric Crystals	(5955)	1	2	3	4	5
12. Electron Tubes & Assoc Hardware	(5960)	1	2	3	4	5
13. Semiconductor Devices & Assoc Hardware	(5961)	1	2	3	4	5
14. Microcircuits, Electronic	(5962)	1	2	3	4	5
15. Electronic Modules	(5963)	1	2	3	4	5

16.	Headsets, Handsets, Microphones & Speakers	(5965)	1	2	3	4	5
17.	Elec Insulators & Insulating Materials	(5970)	1	2	3	4	5
18.	Electrical Hardware & Supplies	(5975)	1	2	3	4	5
19.	Electrical Contact Brushes & Electrodes	(5977)	1	2	3	4	5
20.	Optoelectronic Devices & Assoc Hardware	(5980)	1	2	3	4	5
21.	Antennas Waveguides & Related Hardware	(5985)	1	2	3	4	5
22.	Synchro & Resolvers	(5990)	1	2	3	4	5
23.	Cable, Cord & Wire Assemblies: Comm Equip	(5995)	1	2	3	4	5
24.	Electrical & Elct Assys, Boards, Cards & Assoc Hw	(5998)	1	2	3	4	5
25.	Misc Electrical & Electronic Components	(5999)	1	2	3	4	5
(60) Fiber Optics Material, Comps, Assemblies & Accys							
1.	Rotary Joints	(6004)	1	2	3	4	5
2.	Couplers, Splitters & Mixers	(6005)	1	2	3	4	5
3.	Attenuators	(6006)	1	2	3	4	5
4.	Filters	(6007)	1	2	3	4	5
5.	Optical Multiplexers/Demultiplexers	(6008)	1	2	3	4	5
6.	Fiber Optic Conductors	(6010)	1	2	3	4	5
7.	Fiber Optic Cables	(6015)	1	2	3	4	5
8.	Fiber Optic Cable Assemblies & Harnesses	(6020)	1	2	3	4	5
9.	Fiber Optic Switches	(6021)	1	2	3	4	5
10.	Fiber Optic Transmitters	(6025)	1	2	3	4	5
11.	Fiber Optic Receivers	(6026)	1	2	3	4	5
12.	Optical Repeaters	(6029)	1	2	3	4	5
13.	Fiber Optic Devices	(6030)	1	2	3	4	5
14.	Integrated Optical Circuits	(6031)	1	2	3	4	5
15.	Fiber Optic Light Sources	(6032)	1	2	3	4	5
16.	Fiber Optic Photo Dectectors	(6033)	1	2	3	4	5
17.	Fiber Optic Modulators/Demodulators	(6034)	1	2	3	4	5
18.	Fiber Optic Light Transfer & Image Transfer Devices	(6035)	1	2	3	4	5
19.	Fiber Optic Sensors	(6040)	1	2	3	4	5
20.	Fiber Optic Passive Devices	(6050)	1	2	3	4	5
21.	Fiber Innerconnectors & Supplies	(6060)	1	2	3	4	5
22.	Fiber Optic Accessories & Supplies	(6070)	1	2	3	4	5

23. Fiber Optic Kits & Sets	(6080)	1	2	3	4	5
24. Miscellaneous Fiber Optic Components	(6099)	1	2	3	4	5
(61) Electric Wire, & Power & Distribution Equip						
1. Motors, Electrical	(6105)	1	2	3	4	5
2. Electrical Control Equipment	(6110)	1	2	3	4	5
3. Generators & Generator Sets, Electrical	(6115)	1	2	3	4	5
4. Fuel Cell Power Units, Components & Accys	(6116)	1	2	3	4	5
5. Solar Electric Power Systems	(6117)	1	2	3	4	5
6. Transformers, Distribution & Power Station	(6120)	1	2	3	4	5
7. Converters, Electrical Rotating	(6125)	1	2	3	4	5
8. Converters, Electrical Nonrotating	(6130)	1	2	3	4	5
9. Batteries, Nonrechargable	(6135)	1	2	3	4	5
10. Batteries, Rechargeable	(6140)	1	2	3	4	5
11. Wire & Cable Electrical	(6145)	1	2	3	4	5
12. Misc Electric Power & Distribution Equip	(6150)	1	2	3	4	5
13. Miscellaneous Battery Retaining Fixtures & Liners	(6160)	1	2	3	4	5
(62) Lighting Fixtures & Lamps						
1. Indoor & Outdoor Electric Lighting Fixtures	(6210)	1	2	3	4	5
2. Electric Vehicular Lights & Fixtures	(6220)	1	2	3	4	5
3. Electric Portable & Hand Lighting Equip	(6230)	1	2	3	4	5
4. Electric Lamps	(6240)	1	2	3	4	5
5. Ballasts, Lampholders & Starters	(6250)	1	2	3	4	5
6. Nonelectrical Lighting Fixtures	(6260)	1	2	3	4	5
(63) Alarm, Signal & Security Detection Systems						
1. Traffic & Transit Signal Systems	(6310)	1	2	3	4	5
2. Shipboard Alarm & Signal Systems	(6320)	1	2	3	4	5
3. Railroad Signal & Warning Devices	(6330)	1	2	3	4	5
4. Aircraft Alarm & Signal Systems	(6340)	1	2	3	4	5
5. Misc Alarm & Security Systems	(6350)	1	2	3	4	5
(65) Medical, Dental & Veterinary Equip & Supplies						
1. Drugs & Biologicals	(6505)	1	2	3	4	5
2. Blood	(6506)	1	2	3	4	5
3. Blood Derivatives	(6507)	1	2	3	4	5

4. Medicated Cosmetics & Toiletries	(6508)	1	2	3	4	5
5. Surgical Dressing Materials	(6510)	1	2	3	4	5
6. Medical & Surgical Instruments, Equip & Supplies	(6515)	1	2	3	4	5
7. Dental Instruments, Equip & Supplies	(6520)	1	2	3	4	5
8. X-ray Equip & Sup; Medical, Dental & Vet	(6525)	1	2	3	4	5
9. Hospital Furniture, Equip, Utensils & Sup	(6530)	1	2	3	4	5
10. Hospital & Surgical Clothing	(6532)	1	2	3	4	5
11. Ophthalmic Instruments, Equip & Supplies	(6540)	1	2	3	4	5
12. Medical Sets, Kits & Outfits	(6545)	1	2	3	4	5
13. In Virto Diagnostic Substances, Reagents	(6550)	1	2	3	4	5
(66) Instruments & Laboratory Equipment						
1. Navigational Instruments	(6605)	1	2	3	4	5
2. Flight Instruments	(6610)	1	2	3	4	5
3. Automatic Pilot Mechanisms Airborne Gyro Comps	(6615)	1	2	3	4	5
4. Engine Instruments	(6620)	1	2	3	4	5
5. Electrical & Elct Meas & Test Instruments	(6625)	1	2	3	4	5
6. Chemical Analysis Instruments	(6630)	1	2	3	4	5
7. Physical Property Testing Equipment	(6635)	1	2	3	4	5
8. Environmental Chambers & Related Equip	(6636)	1	2	3	4	5
9. Laboratory Equipment & Supplies	(6640)	1	2	3	4	5
10. Time Measuring Instruments	(6645)	1	2	3	4	5
11. Optical Instruments, Test Equip, Comps & Accys	(6650)	1	2	3	4	5
12. Geophysical Instruments	(6655)	1	2	3	4	5
13. Meteorological Instruments & Apparatus	(6660)	1	2	3	4	5
14. Hazard-detecting Instruments & Apparatus	(6665)	1	2	3	4	5
15. Scales & Balances	(6670)	1	2	3	4	5
16. Drafting Surveying & Mapping Instruments	(6675)	1	2	3	4	5
17. Flow, Level & Motion Measuring Instruments	(6680)	1	2	3	4	5
18. Pressure, Temperature & Humidity Instruments	(6685)	1	2	3	4	5
19. Combination & Miscellaneous Instruments	(6695)	1	2	3	4	5
(67) Photographic Instruments						
1. Cameras, Motion Picture	(6710)	1	2	3	4	5
2. Cameras, Still Picture	(6720)	1	2	3	4	5

3. Photographic Projection Equipment	(6730)	1 2 3 4 5
4. Photo Developing & Finishing Equipment	(6740)	1 2 3 4 5
5. Photographic Supplies	(6750)	1 2 3 4 5
6. Photographic Equipment & Accessories	(6760)	1 2 3 4 5
7. Film, Processed	(6760)	1 2 3 4 5
8. Photographic Sets, Kits & Outfits	(6770)	1 2 3 4 5
(68) Chemicals & Chemical Products		
1. Chemicals	(6810)	1 2 3 4 5
2. Dyes	(6820)	1 2 3 4 5
3. Gases: Compressed & Liquefied	(6830)	1 2 3 4 5
4. Pest Control Agents & Disinfectants	(6840)	1 2 3 4 5
5. Miscellaneous Chemical Specialties	(6850)	1 2 3 4 5
(69) Training Aids & Devices		
1. Training Aids	(6910)	1 2 3 4 5
2. Armament Training Devices	(6920)	1 2 3 4 5
3. Operational Training Devices	(6930)	1 2 3 4 5
4. Communication Training Devices	(6940)	1 2 3 4 5
(70) General Purpose ADP Equip, Software, Sup & Eq		
1. ADPE Configuration	(7010)	1 2 3 4 5
2. ADP Central Processing Unit-Analog	(7020)	1 2 3 4 5
3. ADP Central Processing Unit-Digital	(7021)	1 2 3 4 5
4. ADP Central Processing Unit-Hybrid	(7022)	1 2 3 4 5
5. ADP Input/Output & Storage Devices	(7025)	1 2 3 4 5
6. ADP Software	(7030)	1 2 3 4 5
7. ADP Support Equipment	(7035)	1 2 3 4 5
8. Punch Card Equipment	(7040)	1 2 3 4 5
9. Mini & Micro Computer Control Devices	(7042)	1 2 3 4 5
10. ADP Supplies	(7045)	1 2 3 4 5
11. ADP Components	(7050)	1 2 3 4 5
(71) Furniture		
1. Household Furniture	(7105)	1 2 3 4 5
2. Office Furniture	(7110)	1 2 3 4 5
3. Cabinets, Lockers, Bins & Shelving	(7125)	1 2 3 4 5

4. Miscellaneous Furniture & Fixtures	(7195)	1	2	3	4	5
(72) Household & Coml Furnishings & Appliances						
1. Household Furnishings	(7210)	1	2	3	4	5
2. Floor Coverings	(7220)	1	2	3	4	5
3. Draperies, Awnings & Shades	(7230)	1	2	3	4	5
4. Household & Commercial Utility Containers	(7240)	1	2	3	4	5
5. Misc Household & Coml Furnishings Appliances	(7290)	1	2	3	4	5
(73) Food Preparation & Serving Equipment						
1. Food Cooking, Baking & Serving Equipment	(7310)	1	2	3	4	5
2. Kitchen Equipment & Appliances	(7320)	1	2	3	4	5
3. Kitchen Hand Tools & Utensils	(7330)	1	2	3	4	5
4. Cutlery & Flatware	(7340)	1	2	3	4	5
5. Tableware	(7350)	1	2	3	4	5
6. Sets, Kits, Outfits & Modules, Food Prep & Serving	(7360)	1	2	3	4	5
(74) Office Machines & Visible Record Equipment						
1. Accounting & Calculating Machines	(7420)	1	2	3	4	5
2. Typewriters & Office Type Composing Mach	(7430)	1	2	3	4	5
3. Office Information System Equipment	(7435)	1	2	3	4	5
4. Office Type Sound Recording Repro Mach	(7450)	1	2	3	4	5
5. Visible Record Equipment	(7460)	1	2	3	4	5
6. Miscellaneous Office Machines	(7490)	1	2	3	4	5
(75) Office Supplies & Devices						
1. Office Supplies	(7510)	1	2	3	4	5
2. Office Devices & Accessories	(7520)	1	2	3	4	5
3. Station & Record Forms	(7530)	1	2	3	4	5
4. Standard Forms	(7540)	1	2	3	4	5
(76) Books, Maps & Other Publications						
1. Books & Pamphlets	(7610)	1	2	3	4	5
2. Newspapers & Periodicals	(7630)	1	2	3	4	5
3. Maps, Atlases Charts & Globes	(7640)	1	2	3	4	5
4. Drawings & Specifications	(7650)	1	2	3	4	5
5. Sheet & Book Music	(7660)	1	2	3	4	5

6. Microfilm Processed	(7670)	1 2 3 4 5
7. Miscellaneous Printed Matter	(7690)	1 2 3 4 5
(77) Musical Inst , Phonographs & Home-Type Radios		
1. Musical Instruments	(7710)	1 2 3 4 5
2. Musical Instruments Parts & Accessories	(7720)	1 2 3 4 5
3. Phonographs, Radios & TV Sets: Home-Type	(7730)	1 2 3 4 5
4. Phonograph Records	(7740)	1 2 3 4 5
(78) Recreational & Athletic Equipment		
1. Athletic & Sporting Equipment	(7810)	1 2 3 4 5
2. Games, Toys & Wheeled Goods	(7820)	1 2 3 4 5
3. Recreational & Gymnastic Equipment	(7830)	1 2 3 4 5
(79) Cleaning Equipment & Supplies		
1. Floor Polishers & Vacuum Cleaning Equip	(7910)	1 2 3 4 5
2. Brooms, Brushes, Mops & Sponges	(7920)	1 2 3 4 5
3. Cleaning & Polishing Compounds & Preps	(7930)	1 2 3 4 5
(80) Brushes, Paints, Sealers & Adhesives		
1. Paints, Dopes, Varnishes & Related Products	(8010)	1 2 3 4 5
2. Paint & Artist Brushes	(8020)	1 2 3 4 5
3. Preservative & Sealing Compounds	(8030)	1 2 3 4 5
4. Adhesives	(8040)	1 2 3 4 5
(81) Containers, Packaging & Packing Supplies		
1. Bags & Sacks	(8105)	1 2 3 4 5
2. Drums & Cans	(8110)	1 2 3 4 5
3. Boxes, Cartons & Crates	(8115)	1 2 3 4 5
4. Commercial & Industrial Gas Cylinders	(8120)	1 2 3 4 5
5. Bottles & Jars	(8125)	1 2 3 4 5
6. Reels & Spools	(8130)	1 2 3 4 5
7. Packaging & Packing Bulk Materials	(8135)	1 2 3 4 5
8. Ammunition & Nuclear Ordanance Containers	(8140)	1 2 3 4 5
9. Specialized Shipping & Storage Containers	(8145)	1 2 3 4 5
(83) Tex, Lthr, Fur, Apparl & Shoe Finding, Tent & Flag		
1. Textile Fabrics	(8305)	1 2 3 4 5

2. Yarn & Thread	(8310)	1 2 3 4 5
3. Notions & Apparel Findings	(8315)	1 2 3 4 5
4. Padding & Stuffing Materials	(8320)	1 2 3 4 5
5. Fur Materials	(8325)	1 2 3 4 5
6. Leather	(8330)	1 2 3 4 5
7. Shoe Findings & Soling Materials	(8335)	1 2 3 4 5
8. Tents & Tarpaulins	(8340)	1 2 3 4 5
9. Flags & Pennants	(8345)	1 2 3 4 5
(84) Clothing, Individual Equipment & Insignia		
1. Outerwear, Men's	(8405)	1 2 3 4 5
2. Outerwear, Women's	(8410)	1 2 3 4 5
3. Clothing, Special Purpose	(8415)	1 2 3 4 5
4. Underwear & Nightwear, Men's	(8420)	1 2 3 4 5
5. Underwear & Nightwear, Women's	(8425)	1 2 3 4 5
6. Footwear, Men's	(8430)	1 2 3 4 5
7. Footwear, Women's	(8435)	1 2 3 4 5
6. Hosiery, Handwear & Clothing Accy, Men's	(8440)	1 2 3 4 5
7. Hosiery, Handwear & Clothing Accy, Women's	(8445)	1 2 3 4 5
8. Children's & Infant's Apparel & Accy	(8450)	1 2 3 4 5
9. Badges & Insignia	(8455)	1 2 3 4 5
10. Luggage	(8460)	1 2 3 4 5
11. Individual Equipment	(8465)	1 2 3 4 5
12. Armor, Personal	(8470)	1 2 3 4 5
13. Specialized Flight Clothing & Accessories	(8475)	1 2 3 4 5
(85) Toiletries		
1. Perfumes, Toilet Preparations & Powders	(8510)	1 2 3 4 5
2. Toilet Soap, Shaving Prep & Dentifrices	(8520)	1 2 3 4 5
3. Personal Toiletry Articles	(8530)	1 2 3 4 5
4. Toiletry Paper Products	(8540)	1 2 3 4 5
(87) Agriculture Supplies		
1. Forage & Feed	(8710)	1 2 3 4 5
2. Fertilizers	(8720)	1 2 3 4 5
3. Seeds & Nursery Stock	(8730)	1 2 3 4 5

(91) Fuels, Lubricants, Oils & Waxes							
1. Fuels, Solid	(9110)	1	2	3	4	5	
2. Liquid Propellants & Fuel, Petroleum Base	(9120)	1	2	3	4	5	
3. Liquid Propellant Fuels & Oxidizers, Chem Base	(9130)	1	2	3	4	5	
4. Fuel Oils	(9140)	1	2	3	4	5	
5. Oil & Greases: Cutting, Lubr & Hydraulic	(9150)	1	2	3	4	5	
6. Miscellaneous Waxes, Oils & Fats	(9160)	1	2	3	4	5	
7. Miscellaneous Printed Matter	(9190)	1	2	3	4	5	
(93) Nonmetallic Fabricated Materials							
1. Paper & Paperboard	(9310)	1	2	3	4	5	
2. Rubber & Fabricated Materials	(9320)	1	2	3	4	5	
3. Plastics Fabricated Materials	(9330)	1	2	3	4	5	
4. Glass Fabricated Materials	(9340)	1	2	3	4	5	
5. Refactories & Fire Surfacing Materials	(9350)	1	2	3	4	5	
6. Misc Fabricated Nonmetallic Materials	(9390)	1	2	3	4	5	
(94) Nonmetallic Crude Materials							
1. Crude Grades of Plant Materials	(9410)	1	2	3	4	5	
2. Fibers: Vegetable, Animal Products & Synthetic	(9420)	1	2	3	4	5	
3. Misc Crude Animal Products, Inedible	(9430)	1	2	3	4	5	
4. Misc Crude Agriculture & Forestry Products	(9440)	1	2	3	4	5	
5. Nonmetallic Scrap, Except Textile	(9450)	1	2	3	4	5	
(95) Metal Bars, Sheets & Shapes							
1. Wire, Nonelectrical, Iron & Steel	(9505)	1	2	3	4	5	
2. Bars & Rods, Iron & Steel	(9510)	1	2	3	4	5	
3. Plate, Sheet, Strip & Foil: Iron & Steel	(9515)	1	2	3	4	5	
4. Structural Shapes, Iron & Steel	(9520)	1	2	3	4	5	
5. Wire, Nonelectrical, Nonferrous Base Metal	(9525)	1	2	3	4	5	
6. Bars & Rods, Nonferrous Base Metal	(9530)	1	2	3	4	5	
7. Plate, Sheet, Strip & Foil: Nonferrous Metal	(9535)	1	2	3	4	5	
8. Structural Shapes, Nonferrous Based Metal	(9540)	1	2	3	4	5	
9. Plate, Sheet, Strip, Foil & Wire: Precious Metal	(9345)	1	2	3	4	5	
(96) Ores, Minerals & Their Primary Products							

1. Ores	(9610)	1	2	3	4	5
2. Minerals, Natural & Synthetic	(9620)	1	2	3	4	5
3. Additive Metal Materials & Master Alloys	(9630)	1	2	3	4	5
4. Iron & Steel Primary & Semifinished Products	(9640)	1	2	3	4	5
5. Nonferrous Base Metal Refinery	(9650)	1	2	3	4	5
6. Precious Metals Primary Forms	(9660)	1	2	3	4	5
7. Iron & Steel Scrap	(9670)	1	2	3	4	5
8. Nonferrous Metal Scrap	(9680)	1	2	3	4	5
(99) Miscellaneous						
1. Signs, Advertising Displays, & ID Plates	(9905)	1	2	3	4	5
2. Jewelry	(9910)	1	2	3	4	5
3. Collectors and/or Historical Items	(9915)	1	2	3	4	5
4. Smokers Articles & Matches	(9920)	1	2	3	4	5
5. Ecclesiastical Equip, Furnishings & Supplies	(9925)	1	2	3	4	5
6. Memorials: Cemeterial & Mortuary Equip & Sup	(9930)	1	2	3	4	5
7. Nonfood Items for Resale	(9998)	1	2	3	4	5
8. Miscellaneous Items	(9999)	1	2	3	4	5

APPENDIX B

Survey cover letter from Fleet and Industrial Supply Center, San Diego

FLEET AND INDUSTRIAL SUPPLY CENTER
PROCUREMENT MANAGEMENT, CODE P

MEMORANDUM

Pmemo-94-086
9 April 1994

From: Director, Procurement Management
To: Distribution

Subj: PROCUREMENT PRODUCTIVITY MATRIX

Encl: (1) Commodity Complexity Survey

1. With the assistance of Lt. Ben Persinger, a student at Monterey Naval Post Graduate school, we are developing a matrix to determine difficulty involved in purchasing a specific commodity code based on technical intricacies of that commodity only. We need your assistance in the development of this matrix. Enclosure (1) is a survey we are asking you to complete based on your experience and expertise.

2. Your careful evaluation of each commodity code is vital to developing a fair and accurate matrix. If you have no idea how to rate some of the commodities, **please leave them blank**.

3. When rating the commodity codes, do not consider factors such as dollar amounts, procurement methods, required attachments, justifications, or certifications (HAZMAT, FIP, Sole Source, etc.) to support that purchase. These will be factored in separately on the matrix.

4. Please take time to complete this survey today, and return it to Code P, attn: Shelly Pierce. All responses must be returned NLT 20 April 1994 to meet Lt. Persinger's deadline of 22 April, at which time he will compile the statistics and provide us feedback. Thank-you for your time.

Joyce Cozart

Joyce Cozart

APPENDIX C

Statistical data obtained as a result of the survey on perceived complexity of procuring goods within identified commodity groupings.

RATING COMMODITY CODES ON COMPLEXITY

Code	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20	#21	Count	AVG	STD
1210							5	2	5	4	5		4		2	4	4				3	10	3.8	1.077
1220							5	3	5	4	5		4		2	4	4				5	10	4.1	0.943
1230			4				5	3	5	5	5		4		4	4	5				5	11	4.45	0.656
1240							5	2	5	5	5		4		5	4	4				5	10	4.4	0.917
1250							5	3	3	5	5		4		5	3	5				5	10	4.3	0.900
1260							4	2	5	5	5		4		5	3	4				4	10	4.1	0.943
1265							4	2	5	5	5		4		5	3	4				5	10	4.2	0.980
1270							5		5	5	5		5		5	4	5					8	4.88	0.331
1280							5		5	5	5		5		5	4	5					8	4.88	0.331
1285							5		5	5	5		3		5	5	5				5	9	4.78	0.629
1287							5	4	5	5	5		3		5	5	5				5	10	4.7	0.640
1290	1		3				3	3	4	4	5		3		2	3	4			3	4	13	3.42	0.973
1510					5	5	5	5		5	5	5		5			5					9	5	0.000
1520					5	5	5	5		5	5	5		5			5					9	5	0.000
1540					5	5	5	5		5		5		5			5					8	5	0.000
1550					5	5	5	5		5		5					5					7	5	0.000
1560					5	5	5	5		5	5	5		5			5					9	5	0.000
1610					5	5	5	5		5	5	5		5			5					9	5	0.000
1615					4	5	5	5		5	5	5		5			5					9	4.89	0.314
1620					4	5	5	5		5	5	5		5			5					9	4.89	0.314
1630					3	5	5	5		5	5	5		5			5					9	4.78	0.629
1650					3	5	5	5		5	5	5		5			5					9	4.78	0.629
1660					3	5	5	5		5	5	5		5			5					9	4.78	0.629
1670					2	5	5	5	2	5	5	5		5	3		4	3	3	2	3	15	3.8	1.222
1680			3		2	3	3	4	2	5	5	5		5				4		4		12	3.75	1.090
1710					5	5	5	5		5	5	5		5				4				9	4.89	0.314
1720					5	5	5	5	4	5	5	5		5				4			5	11	4.82	0.386
1730					3	5	5	5		5	4	5		5	3	4		4			4	12	4.33	0.745
1740					3	5	5	5		5	4	5		5		4		4		3		11	4.36	0.771
1905							5	2	5		5		5		5	3	4			3	5	10	4.2	1.077
1910							5		5		5	5	5			3	4			3	5	9	4.44	0.831
1915							5		5		5	5	5			3	4			2	4	9	4.22	1.030
1920							4		4		5	3	5			4	4			4		8	4.13	0.599
1925							4	3	4		5	5	5			4	4			4		9	4.22	0.629
1930							4		4		5	5	5			4	4			3		8	4.25	0.661
1935							4		4		5	5	5			4	4				4	8	4.38	0.484
1940	1		3				4	2	3		5	5	5	3	4	5	4			3	4	14	3.85	1.172
1945			3				4		3	3	5	5	5		4	5	4			2		11	3.91	0.996
1950			3				4		4		5	5	5		4	4	4			2		10	4	0.894
1955							4		4		5	5	5			3	4					7	4.29	0.700
1990					3	3	3	4	2	3		5	5	5		4	3	4		2		13	3.54	1.009
2010					4	4	4	5	4	5		5	5	4	4	4	4	3		3	5	15	4.2	0.653
2020	2	3			2	2	2	5	3	3		5	5	3	4	3	4	3	3	3	4	18	3.35	0.989
2030					3	3	3	5	4	3		5	5	4	5	4	4	3	2	4	5	16	3.88	0.927
2040	2	3			2	2	2	4		5		5	5	4	4	4	4	3		2	5	16	3.6	1.173
2050			1		3	3	3	4		3	4	5	4	3	3	3	4	3		2	3	16	3.19	0.882
2060					2			4		3		5	3	3			3	4		2		9	3.22	0.916
2090	2	3			1	2	2	3	3	3		5	5	3	4	3	3	3		2		16	3	1.029
2210							5		5		5		4		3		5					6	4.5	0.764
2220							5		5		5		5		3		5					6	4.67	0.745
2230							5		4		5		3		3		5					6	4.17	0.898

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3405			3	2	2	2	2	4	3	2	2	5	3	3	3	2	3	3	2	2	4	19	2.74	0.849
3408					3	3	3	4		3	3	5	4	3	3	2	3	3		3		14	3.21	0.674
3410								5		3	4	5	4	3	3	2	4	4		3		11	3.64	0.881
3411					3	3	3	3	4	3	3	5	3	3	3	2	3	3		2	4	16	3.13	0.896
3412								3		3		5	4	3		2	3	3		2		9	3.11	0.875
3413				2	3	3	3	2	4	3	3	5	3	3	3	2	3	3		2	4	17	3	0.767
3414				2	3	3	3	3	4	3	3	5	3	3	3	2	3	3		2	4	17	3.06	0.725
3415			3	2	3	3	3	2	4	2	3	5	3	3	3	2	3	3		2	4	18	2.94	0.780
3416			3		3	3	3	5	3	3	3	5	3	3	3	2	3	3		2	3	17	3.12	0.758
3417			3		3	3	3	3		3	4	5	3	3	3	2	3	3		3	4	16	3.19	0.634
3418					3	3	3	2	3	2	3	5	3	3	3	2	3	3		3	4	16	3	0.707
3419	2			2	2	2	2	1	3	2	2	5	3	3	3	2	4	3		1	3	18	2.53	0.957
3422				2				4		3	4	5	4	3	3	2	4	3		2		12	3.25	0.924
3424					4	4	4	5		2	3	5	4	3	4	2	3	3		2		14	3.43	0.979
3426			3		3	3	3	3	3	2	2	5	3	3	3	2	3	3		3	4	17	3	0.686
3431	2	3	3	2	3	3	3	3	3	3	2	5	3	3	4	2	4	3	2	2		20	2.95	0.768
3432					3	3	3	4	3	3	2	5	3	3	4	2	3	3		2	4	16	3.13	0.781
3433			3		3	3	3	3		3	2	5	3	3	4	2	3	3	2	3	4	17	3.06	0.725
3436					3	3	3	3		2		5	5	3	3	2	2	3				12	3.08	0.954
3438		3	3		2	2	2	2	2	2	2	5	3	3	3	2	2	3		2	4	18	2.61	0.826
3439		3			2	2	2	1	2	2	2	5	2	3	3	2	2	3	2	1	3	18	2.33	0.882
3441					3	3	3	3		2	3	5	4	3	3	2	3	3		2	4	15	3.07	0.772
3442					3	3	3	5	3	3	4	5	4	3	4	2	3	3		3		15	3.4	0.800
3443					3	3	3	5	3	3	4	5	3	3	4	2	3	3		3		15	3.33	0.789
3444					2	2	2	3		3	3	4	3	3	3	2	2	3		3		14	2.71	0.589
3445					3	3	3	2		2	2	5	3	3	3	2	2	3		2	3	15	2.73	0.772
3446					3	3	3	3		3	2	5	3	3	3	2	2	3		2	3	15	2.87	0.718
3447					3	3	3	3		3	3	5	3	3	3	2	2	3		2		14	2.93	0.703
3448					3	3	3	3	2	3	2	5	3	3	3	2	2	3		1	3	16	2.75	0.829
3449					3	3	3	3		3	2	5	3	3	3	2	2	3		2		14	2.86	0.742
3450			2	2	2	2	2	3	3	2	2	5	3	3	3	2	2	3	1	1	3	19	2.42	0.878
3455	2			2	2	2	2	3	3	1	2	5	3	3	3	2	2	3	1	1	3	19	2.39	0.930
3456					2	2	2	3	3	1	2	5	3	3	3	2	2	3	1	1		16	2.38	0.992
3460	2			2	2	2	2	1	2	1	2	5	3	3	3	2	2	3	1	1	3	19	2.22	0.950
3461				2	2	2	2	1		1	1	5	3	3	3	2	2	3		2		15	2.27	0.998
3465					2	2	2	1	2	2	3	5	2	3	4	2	2	3		2		15	2.47	0.957
3470					2	2	2	1	3	1	1	5	2	3	3	2	2	3	1	3	4	17	2.35	1.081
3510		3		3	3	3	3	4		2	3	4		3	4	3	2	3		2	4	16	3.06	0.658
3520					3	3	3	4		2	1	3		3		3	2	3				11	2.73	0.750
3530					3	3	3	4	3	2	2	3		3	4	3	2	3		2	3	15	2.87	0.618
3540				3	3	3	3	4		2	3	4		3	4	3	2	3	2	3	4	16	3.06	0.658
3550					2	2	2	1		3	3	3		3	3	2		3				11	2.45	0.656
3590				3	2	3	2	1	3	3	2	3		3	4	1		3		3		14	2.57	0.821
3605		2	3	3	2	2	2	4			2	4	3	4	4	4	3	2	2	2	4	18	2.89	0.875
3610		3	3	3	2	2	2	4	4	2	4	4	3	4	4	4	3	3		2	4	19	3.16	0.812
3611					2	2	2	3		2	4	4		3	3	4	3	3		2	4	14	2.93	0.799
3615					2	2	2	4		2	4	4		4	3	4	3	4	2	3		14	3.07	0.884
3620					2	2	2	4		2	4	4		4	3	4	3	3		3		13	3.08	0.828
3625					2	2	2	4		2	4	4		4	4	4	3	3				12	3.17	0.898
3630					2	2	2	4		2	3	4		4	3	4	3	3			4	13	3.08	0.828
3635					2	2	2	4		2	3	4		4	3	4	3	3				12	3	0.816
3640								5		2	1	4		4	3	4	3	4				9	3.33	1.155

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RATING COMMODITY CODES ON COMPLEXITY

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RATING COMMODITY CODES ON COMPLEXITY

6250			1		2	2	2	2		1			5	1	2	4	2	1	3	1	2	3							16	2.13	1.111
6260			1		2	2	2	2	2	1	1	4	1	2			2	1	3	1	1	3							17	1.82	0.856
6310					3	3	3	4		2	3	5		3			3	4	4	2	2								13	3.15	0.863
6320					3	3	3	4	5	3	4	5		5	5		5	4	4		3	4							15	4	0.816
6330								4		3		5		3			5	4	4										7	4	0.756
6340						5		5		4	5	5		3			5	4	4										9	4.44	0.685
6350	5		3	3	4	4	4	3	5	1	3	5		3			5	4	4	2	3								17	3.5	1.088
6505	5	2	2	1	3	3	3	5	3	2	5	5		4	4		5	3	4			5							18	3.47	1.257
6506								5		2	5	5		4	4		5		4										8	4.25	0.968
6507								5		2	5	5		4	4		5	4	4										9	4.22	0.916
6508					3		3	4		2	2	5		4			3	3	3										10	3.2	0.872
6510	2			1		3	3	3	3	2	3	5		4	3		4	3	4	2	3	5							17	3.19	1.022
6515	2	2	2	2			4	3	4	2	5	5		4	4		4	4	3	1		5							17	3.38	1.225
6520	2	2	2	2	4	4	4	4	4	2	4	5		4	4		4	3	3	1	3	5							20	3.37	1.100
6525				3	4	4	4	5	4	2	5	5		4	4		5	3	3	1	4	5							17	3.82	1.097
6530				2	3	3	3	3	4	2	3	5		4			3	3	3	1	3	5							16	3.13	0.992
6532	1			1	2	2	2	3	2	2	2	5		4			3	5	3		2	4							16	2.8	1.210
6540				2	4	3	4	3		2	3	5		4			3	5	3	1	3								14	3.21	1.081
6545	4			2	4	3	4	3		2	2	5		4			3	5	3		3	4							15	3.36	0.952
6550		2	2		3	3	3	4		2	5	5		4			5	3	3		4								14	3.43	1.050
6605					3	4	4	5	5	2	5	5		4	5		4	5	3		5	5							15	4.27	0.929
6610					3	4	4	5		2	5	5		4			5	5	4		5								12	4.25	0.924
6615						5	4	5		2	5	5		4			5		5		5								10	4.5	0.922
6620					4	4		5	2	2	3	5		4			4		3		3								11	3.55	0.988
6625	2	3	3		4	4	4	5	5	2	4	5		4	4		4		3	3	4								17	3.81	0.892
6630					4	4	4	5	5	2	5	5		4	4		5	4	4	3	3	5							16	4.13	0.857
6635								4	5	2	5	5		4			4	3	4		3								10	3.9	0.943
6636								5	3	2	5	5		4			5	2	4		4								10	3.9	1.136
6640	2	3		3	4	4	4	5	3	2	5	5		4	4		4	2	3	2	3	5							19	3.61	1.045
6645			3		3	3	3	5	3	2	4	5		4	4		3	2	3	3	3								16	3.31	0.845
6650				3	4	4	4	5	3	2	5	5		4	4		4	2	3		3								15	3.67	0.943
6655								5		2	5	5		4			4	3	4		4								9	4	0.943
6660		3			4	4	4	5		2	5	5		4			5	3	4	3	5								14	4	0.926
6665				3	4	4	4	5	4	2	5	5		4	4		5	3	4	3	5	5							17	4.06	0.872
6670				2	3	3	3	3		2	2	5		4	4		3	2	3	3	3	4							16	3.06	0.827
6675				2	3	3	3	3	4	2	4	5		4	3		4	2	3		3								15	3.2	0.833
6680					3	3	3	3	4	2	5	5		4	4		4	2	3		3								14	3.43	0.904
6685		3			4	3	3	4		2	4	5		4	3		4	2	3	1	3								15	3.2	0.980
6695				3	4	3	4	3	3	2	3	5		4	4		3	2	3		3								15	3.27	0.772
6710			1		3	3	3	3	3	2	3	4	3	3	3		3	3	3		3	5							17	3	0.767
6720	1		1		3	3	3	3	2	2	2	4	3	3	3		3	2	3	2	2	5							19	2.72	0.930
6730			1	2	3	3	3	3	2	2	3	4	3	3	3		3	2	3	2	2	5							19	2.74	0.849
6740			2	3	3	2	3	4	2	2	2	5	3	3	3		3	2	3		2	5							18	2.89	0.936
6750	1	2	1	1	2	2	2	1	2	2	1	5	3	3	3		2	2	3	1	1	5							21	2.2	1.166
6760	1		2	3	2	2	2	3	2	2	2	5	3	3	3		2	2	2	1	1	1							20	2.26	0.927
6760		2	1	1	2	1	2	2	2	2	1	5	3	3	3		1	1	3	1	1	3							20	2	1.049
6770	2		1	1	2	2	2	3	2	2	1	5	3	3	3		2	2	3	1	2	5							20	2.37	1.108
6810	2			2	3	3	3	5	3	3	5	5	5	3	4		5	5	3	2	2	5							19	3.67	1.184
6820				1	3	3	3	5		3	2	55		3			5	3	3		2								13	7	13.895
6830		3		3	3	3	3	5	4	3	5	5		3	5		5	3	4	2	3								17	3.65	0.967
6840				3	3	3	3	5		3	5	5		3	4		5	3	3	2	3								15	3.53	0.957
6850				3	3	3	3	5	4	3	3	5		3	4		5	4	3	2	3								16	3.5	0.866

RATING COMMODITY CODES ON COMPLEXITY

6910			2	1	3	3	3	2	3	1	2	5	2		3	2	2	3	1	2	4	18	2.44	1.012
6920								5		1		5				4	2	3		2		7	3.14	1.457
6930								4	3	1		5				4	2	3		2		8	3	1.225
6940				2				4	3	1	3	5			4	3	2	3		2	4	12	3	1.080
7010			4	3	3	3	3	5	3	2	4	5	5	3	4	4	4	3	2	4	5	19	3.63	0.930
7020				3	3	3	3	5	3	2	4	5	5	3	4	4	4	3		5	5	17	3.76	0.941
7021				3	3	3	3	5		2	4	5	5	3	4	4	4	3		5		15	3.73	0.929
7022				3	3	3	3	5		2	4	5	5	3	3	4	4	3		5		15	3.67	0.943
7025				3	3	3	3	3		2	4	5	5	3	3	4	4	3		4	5	16	3.56	0.864
7030	1		2	3	3	3	3	2	2	2	3	5	3	3	3	3	3	3	2	3	5	20	2.95	0.910
7035	1	3	3	2	3	3	3	3	2	2	3	5	5	3	3	3	3	3	2	3	5	21	3.1	0.976
7040					3	3	3	3	2	2	2	5	5	3		3	3	3		2	5	15	3.13	1.024
7042				3	3	3	3	3	2	2	3	5	5	3	3	3	3	3		3		16	3.13	0.781
7045	1	2	1	2	3	3	3	1	2	2	2	5	3	3	3	3	2	3	2	2	4	21	2.55	0.957
7050	5	3	2	2	3	3	3	2	2	2	2	5	5	3	3	3	2	3	2	3	5	21	2.9	1.069
7105			2	3	3	3	3			1	2	3		2	3	3	2	2	1	2	4	16	2.44	0.788
7110	4		2	4	3	3	3			1	1	3	1	2	3	3	2	2	1	2	4	18	2.35	1.012
7125	3		2	3	3	3	3		2	1	2	3	1	2	3	3	2	2	1	2	4	19	2.33	0.809
7195	4		2	3	3	3	3			1	2	3	1	2	3	3	2	2	1	2	4	18	2.35	0.896
7210			2	2	4	4	4	4		2	1	3		2	3	4	2	2	1	2		16	2.63	1.053
7220	2		2	2	4	4	4	4		2	1	3	1	2	3	4	2	2	1	3	4	19	2.67	1.086
7230			2	2	4	4	4	4		2	1	3		2	3	4	2	2	1	1	4	17	2.65	1.135
7240			2	2	4	4	4	3	2	2	1	3		2	3	2	2	2	1	1	4	18	2.44	1.012
7290			2	1	4	4	4	3	2	2	1	3		2	3	4	2	2	1	2	4	18	2.56	1.066
7310	1	2	2	2	3	3	3	4	2	2	1	3		2	3	3	2	2	1	3	5	20	2.53	0.973
7320		2	3	2	3	3	3	3	2	2	1	3		2	3	3	2	2	1	4	5	19	2.58	0.936
7330		2	1	1	1	1	1	3	2	2	1	3		2	3	3	2	2	1	3	4	19	2	0.918
7340				1	1	1	1	3	2	2	1	3		2	3	1	2	2	1	2	3	17	1.82	0.785
7350				1	1	1	1	2	2	2	1	3		2	3	1	2	2	1	2	3	17	1.76	0.730
7360		2	1	1	1	1	1	2	2	2	1	3		2	3	1	2	2	1	2	4	19	1.79	0.832
7420	1		1	1	2	2	2	1	2	2	1	4	1	2	3	3	2	2	1	2	4	20	2	0.921
7430	3		1	1	2	2	2	1	2	2	1	4	1	2	3	3	2	2	2	2	4	20	2.05	0.889
7435			4	2	2	2	2	2	2	2	3	4	4	3	3	3	2	2		3	4	18	2.72	0.803
7450			3	1	2	2	2	2	2	2	2	4	1	2	3	3	2	2		3	4	18	2.33	0.816
7460	1		1		2	2	2	3	2	2	1	4	1	2	3	3	2	2	1	4	4	19	2.28	1.004
7490		2	1	1	2	2	2	2	2	2	1	4		2	3	3	2	2	1	3	4	19	2.16	0.874
7510	1	2	1	1	1	1	1	1	2	1	1	4	1	2	2	1	2	2	1	1	4	21	1.6	0.904
7520	1		1	1	1	1	1	1	2	1	1	4	1	2	2	1	2	2	1	1	4	20	1.58	0.921
7530	1		1		1	1	1	1	2	1	1	4	1	2	2	1	2	2	1	1	4	19	1.61	0.936
7540	1		1	1	1	1	1	1	2	1	2	4	1	2	2	1	2	2	1	1	4	20	1.63	0.917
7610	1	1	1	1	1	1	1	1	2	1	1	3	1	2	2	1	1	2	1	1	4	21	1.45	0.791
7630	1	1	1	1	1	1	1	2	2	1	1	3	1	2	2	1	1	2	1	2	4	21	1.55	0.794
7640		1	1	1	1	1	1	2	2	1	2	3	1	2	2	1	1	2	1	2		19	1.47	0.595
7650			1	1	1	1	1	3	2	1	2	3	1	4	4	1	2	3	1	2	4	19	2	1.124
7660			1	1	1	1	1	1		1	1	3	1	2	2	1	1	2	1	2		17	1.35	0.588
7670			1	1	1	1	1	3	2	1	2	3	1	2	4	1	1	2	1	2	4	19	1.79	1.004
7690			1	1	1	1	1	1	2	1	1	3	1	2	3	1	1	2	1	2		18	1.44	0.685
7710				1	3	3	3	3	2	2	1	3		2	3	1	2	2		3		15	2.27	0.772
7720				1	2	2	2	2	2	2	1	3		2	3	1	2	2		2		15	1.93	0.573
7730			2	1	2	2	2	2	2	2	2	3	2	2	3	1	2	2		2	4	18	2.11	0.657
7740			1	1	2	2	2	1	2	2	1	3		2	3	1	2	2		3		16	1.88	0.696
7810	2		2	2	2	2	2	3	2	1	1	3	2	2	4	2	2	2	1	2	4	20	2.16	0.792

RATING COMMODITY CODES ON COMPLEXITY

7820			2	2	2	2	2	2		1	1	3	2	2	3	1	2	2	1		2	4	18	2	0.745
7830	4		2	2	3	3	3	3	2	1	2	3	2	2	4	2	2	4	1		2	4	20	2.47	0.921
7910	1	2	2	2	2	2	2	3	2	2	3	4		2	3	3	1	2	1		2	4	20	2.32	0.829
7920	1			1	1	1	1	1	2	1	1	3		1	2	1	1	2	1		1	3	18	1.41	0.678
7930	3	2		1	1	1	1	5	2	1	2	3		1	4	1	1	3	1		2	4	19	2	1.234
8010	1	2	1	2	2	2	2	5	2	1	5	5	1	2	4	5	1	3	1		2	3	21	2.55	1.435
8020	1		1	1	2	2	2	5	2	1	1	4		2	3	5	1	3	1		2	3	19	2.28	1.281
8030	1	2			2	2	2	5	2	1	5	5		2	4	5	1	3	1		2	3	18	2.76	1.453
8040	1			1	2	2	2	5	2	1	5	5	1	2	4	5	1	3	1		1	3	19	2.56	1.534
8105			1		2	2	2	2		2	1	3	1	1	3	1	1	2			1	3	16	1.75	0.750
8110			1	2	2	2	2	2		2	2	5	1	1	3	1	1	2			1	3	17	1.94	0.998
8115	2		1	2	2	2	2	2		2	1	3	1	1	3	1	1	2			1	3	18	1.76	0.711
8120	5			3	3	3	3	3	4	2	4	5	1	2	4	2	1	4	1		2	4	19	2.83	1.234
8125				1	1	1	1	2		2	1	3	1	1	3	1	1	2	1		1	3	17	1.53	0.776
8130				2	2	1	2	3		2	2	3	1	1	3	1	1	2			1	3	16	1.88	0.781
8135	2				2	1	2	3	2	2	2	3	1	3	3	1	1	3	1		1	3	18	2	0.816
8140					3	3	3	5		2		5		4	4	4	3	4			3		12	3.58	0.862
8145	4			2	3	3	3	4	2	2	3	5		3	3	3	3	3			3		16	3	0.747
8305					3	4	4	3	2	2	1	4		2	4	3	3	2			2		14	2.79	0.939
8310					2	2	2	3		2	1	4		1	2	3	1	2			2		13	2.08	0.828
8315					2	2	2	3		2	1	4		12	2	3	1	2			2		13	2.92	2.730
8320					4	4	4	3		2	2	4		1	3	3	1	2			2	4	14	2.79	1.081
8325					3	3	3	4		2	1	4		1		3	1	3			3		12	2.58	1.037
8330					3	3	3	3		2	1	4		1		3	1	3			3		12	2.5	0.957
8335					2	2	2	3		2	1	4		1		3	1	3			3		12	2.25	0.924
8340	3		2		3	3	3	4		2	2	4		1	3	3	1	2	2		2	3	17	2.5	0.848
8345		1	1		2	2	2	3	2	2	2	4	1	1	2	3	1	2	1		1	3	19	1.89	0.852
8405	1	1	2	1	2	2	2	3	2	1	1	3		1	3	3	1	2			2	4	19	2	0.887
8410	1			1	2	#	2	3		1	1	3		1	3	2	1	2			2	4	16	3.33	4.940
8415	1	1	2	1	3	3	3	3	3	1	3	4		1	4	2	2	2	1		2	4	20	2.37	1.054
8420					2	2	2	3		1	1	3		1		2		2			1		11	1.82	0.716
8425					2	2	2	3		1	1	3		1		2		2			1		11	1.82	0.716
8430	1	1	2		2	2	2	3		1	1	3		1	3	2	2	2			1	4	17	2	0.872
8435	1				2	2	2	3		1	1	3		1	3	2	2	2			1	4	15	2.07	0.894
8440				1	2	2	2	3		1	1	3		1		2		2			1		12	1.75	0.722
8445					2	2	2	3	2	1	1	3		1				2			1		11	1.82	0.716
8450								2		1	1	3		1		1		2			1		8	1.5	0.707
8455	1	1	1	1	1	1	1	1		1	2	3		1	3	3	2	2	1		2	4	19	1.72	0.921
8460								2		1	1	3		1		1		2			1		8	1.5	0.707
8465								3		1		3		1		1		2			2		7	1.86	0.833
8470		3	2	1	3	3	3	5		1	4	5		1		3		2	2		2	4	16	2.75	1.250
8475					3	3	3	5	2	1	5	5		1	4	4	3	3	2		3	4	16	3.19	1.236
8510								3		1	1	3		1		1		2			1	4	9	1.89	1.100
8520					2	2	2	3		1	1	3		1		1		2			1	4	12	1.92	0.954
8530					2	2	1	3		1	1	3		1		1		2			1		11	1.64	0.771
8540	1				1	1	1	3		1	1	3		1		1	2	2	1		1	4	15	1.64	0.952
8710								4		2		5		2		1		3			2		7	2.71	1.278
8720				1				5		2		5	1	2	4	1	2	3	1		2		12	2.42	1.441
8730								4		2		5	1	2	3	2		3	1		2		10	2.5	1.204
9110				2				5		2		5		3	4	5	3	4			3	4	11	3.64	1.068
9120				2	3	3	3	5		2	4	5		3	4	5	3	4			3	4	15	3.53	0.957
9130				2	3	3	3	5		2	4	5		3	4	5	3	4			2		14	3.43	1.050

9140		2		3	3	3	5	2	2	4	5		3	4	5		4	2	3	4			16	3.38	1.053
9150	2	1		3	3	3	5	3	2	3	5	1	3	4	5	3	4	2	3	4			19	3.17	1.165
9160				2	2	2	5	2	2	2	5		3	3	5		4	2	2				14	2.93	1.223
9190				2	2	2	2	2	2	1	5		3	3	5	2	3	1	2				15	2.47	1.147
9310	1			1	1	1	2	2	2	1	4		1	3	1	2	2	1	1	4			17	1.81	1.002
9320	2			2	2	2	4		2	1	5		2	3	4	2	2	1	1	4			16	2.47	1.171
9330				2	2	2	4		2	1	5		2	3	4	2	2	3	1	4			15	2.6	1.143
9340				2	2	2	4		2	1	5		2	3	4	2	2	2	1				14	2.43	1.116
9350				2	2	2	4	2	2	2	5		2	3	4	2	3		1				14	2.57	1.050
9390			2	2	2	2	3		2	1	5		2	3	4		3	2	2				14	2.5	0.982
9410							4		2		5		2		1	3	3						7	2.86	1.245
9420							4		2		5		2		1		3						6	2.83	1.344
9430							4		2		5		2		1		3						6	2.83	1.344
9440							4		2		5		2		1		3						6	2.83	1.344
9450							3		2		5		2		1		3						6	2.67	1.247
9505			1	2	2	2	3	2	2	1	4	1	3	3	4	2	2	2	2	4			18	2.33	0.943
9510			1	2	2	2	3	2	2	2	4	1	3	3	4	2	3	2	1	4			18	2.39	0.951
9515				2	2	2	3		2	2	4	1	3	3	4	2	3	2	2	4			16	2.56	0.864
9520			1	2	2	2	3		2	3	4	1	3	3	4	2	3	2	2	4			17	2.53	0.915
9525		1		2	2	2	3		2	1	4	1	3	3	3	2	3	2	1	4			17	2.29	0.956
9530				2	2	2	3		2	1	4	1	3	3	3	2	3	2	1	4			16	2.38	0.927
9535				2	2	2	3		2	1	5	1	3	3	4	2	3	2	2	4			16	2.56	1.059
9540				2	2	2	3		2	3	5	1	3	3	3	2	3	2	2	4			16	2.63	0.927
9545				2	2	2	3		2	4	5	1	3	3	4	2	3	2	2	4			16	2.75	1.031
9610				5	5	5	4		2	3	5		3		3	2	3						11	3.64	1.150
9620				3	3	0	4		2		5		3		2		3						9	2.78	1.315
9630				4	4	4	5		2		5		3		3		3						9	3.67	0.943
9640				4	4	4	4		2		5		3		4		3	2	3				11	3.45	0.891
9650				4	4	4	4		2		5		3	3	4		3		3				11	3.55	0.782
9660				4	4	4	5		2		5		3	3	4		3						10	3.7	0.900
9670				3	3	3	4		2		5		3		4		3	2	2				11	3.09	0.900
9680				3	3	3	4		2		5	2	3		4		3	2	2				12	3	0.913
9905		1		1	1	1	2	2	1	2	3		2	3	4	2	2	1	1				16	1.81	0.882
9910				3	3	3	2		1	1	3		2		4		2						10	2.4	0.917
9915							4		1	1	3		3		4		2						7	2.57	1.178
9920				3	3	3	3		1	1	3		2		4		2						10	2.5	0.922
9925				3	3	3	3	2	1	1	3		1		4	2	2						12	2.33	0.943
9930				3	3	3	4		1	1	3		3		4		2						10	2.7	1.005
9998							4		1		3		1		4		2		2				7	2.43	1.178
9999			1	3	3	3	3	2	1		3		1	3	4		2	1	2				14	2.29	0.958
TOTAL																							14.75	3.04	0.8526

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